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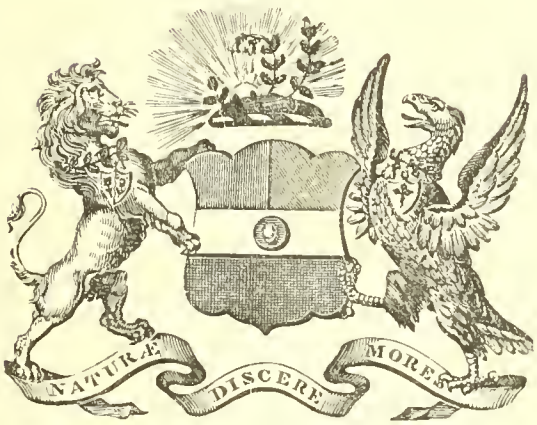

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A Revisional Monograph of Recent Ephemeridæ or Mayflies. *By Rev.* A. E. Eaton, *M.A.* (*Communicated by Sir* John Lubbock, *Bart., F.R.S., ex-President of the Linnean Society.*)

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TRANSACTIONS

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THE LINNEAN SOCIETY.

I. *A Revisional Monograph of Recent Ephemeridæ or Mayflies.* *By the Rev.* A. E. Eaton, *M.A.* (*Communicated by Sir* John Lubbock, *Bart., F.R.S., Pres. Linn. Soc.*)

(Plates I.–LXV.)

Part I. Read April 19th, 1883.

Introductory Remarks.

The present monograph is designed to facilitate the study of the Ephemeridæ. On many accounts these insects are very eligible subjects for scientific research; but so long as they are ill known, and their exact identification a matter difficult of accomplishment, their employment in any branch of zoological learning is surrounded with disadvantages too patent to need indication.

Many points in the classification of the Ephemeridæ formerly doubtful receive elucidation in this work through the kind co-operation of entomologists of various nationality. An unprecedented wealth of material, through their means, has been available for examination, every thing at their disposal likely to be in any way of service to me having been most courteously given or lent by them. The chief contributors of specimens have been Mr. R. M'Lachlan, F.R.S., and Dr. H. A. Hagen, of Cambridge, Mass. I am also under great obligations to Mr. H. Albarda of Leeuwarden, Mr. C. Ritsema of Leyden, the Baron E. de Selys-Longchamps, M. Albert Müller of Berne, M. A. E. Vayssière of Marseilles, and Dr. E. Joly of Toulouse. My thanks are also due respectively to the chief Entomologists or Directors of the British, Oxford, Brussels, Paris (Jardin des Plantes), and other museums, for permitting valuable specimens to be thoroughly examined by me. Many very choice Ephemeridæ in the Museum of Comparative Zoology, Cambridge, Mass., forwarded by Dr. Hagen, and some remarkable species contributed by Mr. O. Salvin, demand particular acknowledgment.

At an initial stage in the preparation of the letterpress, having decided to write in English, the question arose whether or not descriptions of the species should be given, or should the text treat of genera only. The various tints of yellow, brown, grey, and, in a lesser degree, of black, largely prevalent in the coloration of Ephemeridæ, cannot be precisely defined in common English entomological terms so well as in Latin; and

kindred species are often so nearly alike in colour that terms of precision are indispensable in describing the differences between them. When it was settled that the work should be written in its present form, the exigencies of the case were met by having recourse to a trade-colour pattern-book, as a standard of reference, sold by one of the principal artists' colour merchants in London. The samples display three or four gradations of each colour,—intense, medium, light, and sometimes very light. In my descriptions, colours of medium gradation are usually quoted without any qualifying adjective; but in blacks, only the intense gradation is termed black, the medium being designated greyish black, or blackish. The light gradation in blacks and browns, or sometimes the lighter and lightest in a quadruple series of the latter, are referred to as greys of such and such a tint. Very light gradations of red, orange, yellow, green, blue, &c. are denoted as "extremely light," "the lightest possible tint," or "whitish," according to circumstances.

During the interval which will elapse between the issue of the successive parts of this monograph, opportunities will doubtless occur of supplementing the illustrations of species. A list of all additional figures not cited in the text relating to the species represented by them will therefore be given in the final part; and references to them can be made addenda.

Structure of the Ephemeridæ in General.—Adult.

The Ephemeridæ are insects with a long, soft, ten-jointed, sessile abdomen, furnished at its hinder extremity with either two or three many-jointed setaceous or filiform tails (caudal setæ), and whose body is smooth and glabrous.

Head free, with atrophied mouth-organs, carinated epistoma, short subulate antennæ, composed of two short stout joints succeeded by a slender many-jointed setaceous awn, three ocelli, and large oculi (compound eyes).

Thorax robust; mesothorax predominant; sternum well developed; fore wings ample, erect or spreading in repose, plaited lengthwise but not folded up (excepting when a female happens to be ovipositing under water, and then they are reclinate and compactly plicate like a closed fan); legs slender, femora strong, the fore coxæ somewhat distant from the others.

Abdomen armed with a pair of claspers (forceps), in the male placed ventrally at the extremity of the penultimate segment; the vasa deferentia have each of them a separate intromittent organ situated at the ventral joining of the ninth and tenth segments. In the female the oviducts terminate separately in the joining of the seventh and eighth segments; there is no real ovipositor, but in some genera (e. g. *Heptagenia*) the apex of the seventh segment is produced beneath into a short rounded flap, and in one (*Hagenulus*) this projection takes the form of a spout. In many genera there is a similar extension of the ninth segment in one or in both of the sexes. Alimentary canal capacious, straight, filled with gas, and apparently destitute of salivary glands; malpighian tubules in most instances indefinitely numerous, capillary, very long and entangled; but in *Prosopistoma* shorter, stouter in proportion, fewer in number, and combined into one common duct on each side. Tracheæ filamentose or capillary, not saeculated, furnished

with ten pairs of stigmata, two thoracic and eight abdominal. Ventral nervous tract slightly abbreviated, and posteriorly somewhat concentrated, in *Prosopistoma* extremely so.

Peculiarities in structural detail are often noticeable in both or one of the sexes, and are chiefly presented by the ocelli, wings, legs, and caudal setæ, and in the male by the oculi and forceps.

The foremost ocellus is sometimes as large as the others, sometimes much smaller.

The oculi, always much larger in the male than in the other sex, are in him, in some genera, divided each into two parts transversely; the upper portion has larger facets than the lower, and is sometimes coloured differently from it. The division between these segments of the oculus may amount to nothing more than a mere superficial furrow or impressed line traversing the faceted surface horizontally; but when it is deeper, the upper part of the oculus (always much the larger of the two) assumes a short, subcylindrical or turbinate form, faceted only on its summit, and supports on its outer base the smaller division, which is oval, and is faceted all over.

The fore wings, seldom ovate or oblong, are usually trilateral, ample, and rounded off at the extremities. Their margins are unequal in extent, the costal or anterior margin being slightly (sometimes not much) longer than the terminal or outer margin (measured along the curve), and seldom less than double the length of the inner margin. The costal margin is somewhat sinuous as a rule; nearly straight at the base of the wing, it generally presents a shallow sinus midway towards the apex, and then proceeds in a gradual salient curve to its extremity. The terminal margin is arched; its curvature is sometimes stronger towards its extremities than in its midst, where it is occasionally almost straight. In the greater part of its course the inner margin is usually straight or incurved; but there are cases in which it describes a salient curve continuous with that of the terminal margin. The wings are relatively longer in the female than in the male.

The hind wings in some of the genera are not developed; in others they are very minute; at the most they are not particularly large. Their usual form is triangular-ovate, or oblong-ovate, with a salient prominence in front, either close to the wing-roots or midway towards the apex, in which last case the prominence is sometimes (*e. g.* in *Habrophlebia*) followed by a deep sinus; their neuration is fairly plentiful. When they are very minute their nervures are very scanty, and their form is usually oblong or linear-lanceolate.

The inner margin of the fore wing and the anterior margin of the hind wing hitch together automatically to a larger or smaller extent when the wings are spread open.

The wing-membrane is usually glassy and iridescent in the adult. In *Oligoneuria* and some other genera, however, the subimaginal pellicle of the wings is not shed, and these are dim in consequence (viewed as transparencies); their reflection too differs from that of the wings of other Mayflies in being either glossy instead of iridescent, or else (as in *Lachlania* &c.) of uniform azure glow. Pigment is often deposited in the marginal and submarginal areas of the fore wings, and occasionally in all of the wings beside some of the nervures and cross veinlets as well as at the wing-roots; by the confluence of

adjacent deposits blotches and fasciæ are apt to be produced. The wing-membrane is decurrent along the sides of the peak of the mesonotum; in *Oligoneuria* and some allied forms it is there prolonged into short free subulate tails, figured by Dr. Hagen in 1855. In most of the Ephemeridæ, during the subimaginal stage, the wings are fringed with short ciliæ along the terminal margin. This fringe (excepting in *Cænis*, *Prosopistoma*, and *Trycorythus*) is not retained by the adult fly.

Wing-neuration in the Ephemeridæ is less complicated than it appears to be; and where difficulty is experienced in ascertaining the homologies of nervures, it is more likely to be occasioned by the suppression of some of them than from there being more in the wing than can be reasonably accounted for. Unstable in minutiæ, so closely is the essential plan of the neuration adhered to by nearly related Mayflies, that the general facies of the wings is an important aid to their classification, affording characteristics as easily recognizable as the style of branching in the case of trees. Its simplest modifications are displayed in Oligoneurians (Pl. III.), its most complex in Pl. VI.

Throughout the whole series of figures illustrative of neuration, the special and serial homologies of the main nervures of the fore wing and hind wing are indicated by numerals (the same number being employed to denote the same nervure in every figure), and these are placed at the distal extremities of the following nervures, excepting the costa and the sutural nervures, whose numbers are not usually appended to them:—1, the Costa, coincident with the anterior margin of the wing; 2, the Subcosta; 3, the Radius; 4, the Sector; 5, the Cubitus; 6, the Præbrachial; 7, the Pobrachial; 8, the Anal; 9^1, 9^2 &c. Axillary nervures; 10, the Sutural vein coincident with the inner margin. Between these nervures others of an adventitious nature that issue from the wing-margin in certain regions are often interpolated; in many genera they do not remain free, but annex themselves to the adjacent main nervures, often acquiring the appearance and discharging the functions of branches of these. When necessary or advisable for purposes of elucidation, the numeral of the nervure, dashed, is repeated at the extremity of the hindermost adventitious branch.

At a meeting of the Entomological Society of London, in February 1879, I remarked upon the tendency of the main nervures of the anterior wing in most of the Ephemeridæ to be segregated into three groups, of which the first communicates directly with the thorax, the intermediate is either annexed to the first group, or terminates in the wing-membrane adjacent to it, close to the base of the wing, while the third is associated with the prominent curved or angulated crease in the membrane which forms the boundary of a depression posterior to the great cross vein and close to the wing-roots. I mentioned, further, that the anterior nervures of the hinder groups had a proneness to secede from their own set, and transfer themselves to the hindermost nervure of the group next in advance of them, so that in other orders of insects they are usually reckoned as branches of the nervures to which they have strayed. An extreme instance of such a transference is shown in the remarkable aberration figured in Pl. VII. 11 *c*, where the sector (4), accompanied by most of the neighbouring adventitious nervures, has usurped the trunk of the radius (3), so that this last nervure is not in direct continuation with its own basis, but simulates a branch.

Nervures of the fore wing. First group.—The costa (1), the subcosta (2), and radius (3), are strong simple nervures, nearly of the same length, and almost parallel with one another. Close to the base of the wing they are all connected by the great cross vein, and still nearer to the wing-roots the hinder two are again bound firmly by another strong cross vein. In *Palingenia* and some other genera the costa and subcosta are liable to be folded back under the radius, so that this last appears to skirt the edge of the membrane for a considerable distance. In *Elassoneuria* (Pl. III. 3) the subcosta is completely suppressed; and in no case is the adventitious mediastinal ever developed in the Ephemeridæ.

Second group.—The sector (4) and cubitus (5), the præbrachial (6) and pobrachial (7), are the main nervures of the second group. The sector and cubitus (excepting in genera allied to *Oligoneuria*, where one or both of them are suppressed) unite before the middle of the wing, and their common trunk joins the præbrachial towards its termination. The sector is usually reckoned as a branch of the cubitus by entomologists; but it constitutes a separate nervure in the hind wings of many Ephemeridæ. Excepting in wings very scantily nerved, the interval between the sector and cubitus is supplied with adventitious nervures, usually five in number, but sometimes three or six. When there are five of them, the fifth from the sector is the longest, the third the shortest of all, and the first is longer than the second. In *Cloëon* and some other genera cross veinlets afford the only communication between these and the main nervures; but very frequently most of them combine with the first or fourth, and that unites with the sector, the fifth usually remaining alone. When the præbrachial nervure is simple (excepting in allies of *Oligoneuria*) two adventitious nervures are always interposed between it and the pobrachial nervure (Pl. XVI. & XVII.); when it is forked, its fork contains a single adventitious nervure, and its hinder branch is followed by the pobrachial nervure immediately without the interpolation of any nervure whatever. The hinder branch of a forked præbrachial nervure is therefore evidently homologous with the second adventitious nervure, and should be accounted a false branch accordingly. The fork is extremely deep in *Campsurus* and *Polymitarcys* (Pl. V. & VI.).

The pobrachial nervure, somewhat deserted by its fellows, is essentially a simple nervure, any branches which it may appear to have being (like those of the præbrachial) virtually adventitious nervures introduced between it and the anal nervure. Because in this as in the last instance referred to, when the pobrachial nervure is obviously simple (Pl. XVI. & XVII.), two adventitious nervures intervene between it and the anal nervure (8), which sometimes annex themselves to the latter (Pl. I. 1 *b*, 1 *c*); and when the second of them simulates a branch of the pobrachial, the fork thus formed contains a single adventitious nervure within it, and is followed immediately by the anal. Sometimes each of them unites with the nervure to which it is nearest (Pl. V. 8 *a*); in short, the combinations into which they enter with themselves and the adjoining nervures are almost as many as are possible. In *Palingenia longicauda* (Pl. I. 1 *a*), provision seems to be made for the origination of several other adventitious nervures.

Third Group.—The anal (8) and the axillary nervures (9^1, 9^2, &c.) complete the series of main nervures in the disk of the wing. The former, as a rule, subtends the anal

angle directly, receiving some or all of the adventitious nervures that may happen to originate in the interval between itself and the first axillary nervure. But there are many deviations from this rule. In genera related to *Polymitarcys* and in *Palingenia* (Pl. I., II., V. & VI.), from one to five adventitious nervures come between the anal nervure and the anal angle; while in *Bætisca* (Pl. XXI.), where no nervure worthy of mention intervenes before the axillaries, the first and second nervures of this last group extend to the terminal margin between the said angle and the anal nervure. The usual interpolated nervures in other instances are occasionally intercepted by the first axillary instead of by the anal nervure (Pl. XI. 18, &c.). In several genera the last of these adventitious nervures sometimes assumes the aspect of a main branch of the anal nervure (Pl. I.–III. &c.).

The axillary nervures seldom extend beyond the middle of the inner margin; but in *Cloëon* and its allies (Pl. XVI. & XVII.) the first of them reaches to where the anal angle would be in wings of a more distinctly trilateral form, and in *Bætisca* (as has been stated just above) both it and the second axillary nervure terminate beyond this angle. In *Oligoneuria* and kindred genera the axillary nervures are either suppressed, or are represented only by a very few short obsolescent rudiments at the commencement of the inner margin.

By careful inspection of the third group of nervures, observing especially the disposition of the proximal extremities of the main nervures along the prominent curved fold of the membrane, the form of the area contained by the first axillary nervure and the inner margin, or of that enclosed between the first and the second of the axillary nervures, and lastly, the general aspect of the adventitious and other nervures, the approximate affinities of Ephemeridæ to one another can be ascertained very easily.

Cross veinlets, speaking generally, are of very small account in classification, though the contrary was formerly supposd. Their relative abundance or scarcity in the marginal area used to be considered as an item of prime importance; but the sexes of the same species sometimes (*e. g.* certain species of *Cloëon*) differ from one another, in respect of this very particular, more than, in other instances, the species of different genera. They occasionally are serviceable in the distinction of species, more especially the veinlets in the pterostigmatic portion of the marginal area: in some genera these are indifferently simple or branched in individual examples of the same species, and their branches are apt to anastomose with one another. The nature of the series of anastomosing branches is obvious enough in actual specimens of the insects, but in figures of wings it is liable to be mistaken for an adventitious longitudinal nervure, as has recently been done by a distinguished entomologist. Several of the genera related to *Oligoneuria* have a peculiar arrangement of elevated folds and cross veinlets forming communications between the main nervures close to their proximal extremities, to which attention was first directed by Dr. Hagen in 1855. They are indicated in only one of my figures (Pl. III. 2 *a*, ♀).

Nervures of the Hind Wing. First Group.—A noticeable difference is perceptible in the composition of the first group of nervures in the hind wing, compared with the corresponding group in the other wing, because the cubitus (5) is transferred to it from the second group, and is annexed to the radius (3) either near the base (Pl. I. 1 *a*), or

nearer the middle of the wing (Pl. XII.), the sector and the adjacent adventitious nervures either remaining apart from both or forming a union with either of them. When the costa is not rounded off at the extreme base, it almost always describes a salient angle in or before the middle of the anterior margin, after which it becomes approximated to the subcosta (2); and this last, when not straight nor evenly curved, is strongly arched towards its proximal extremity. The radius (3) takes a nearly direct course to the further border of the wing, near the apex, so that a relatively wide space is left between it and the subcosta: in *Bætisca* it is interrupted, or obsolescent. The sector and adventitious nervures (4–4¹) are suppressed in scantily nerved wings, but vary in number and in their combinations in other instances. The sector alone is present in some species of *Campsurus* (Pl. V. 8 *b*); but in most genera there are at least two adventitious nervures associated with it, the hinder one of which usually unites with the sector, so as to form a fork, including its fellow. Another arrangement occurs sometimes in *Polymitarcys* (Pl. VI. 10 *a*) where three such nervures are interposed; in *Palingenia* (Pl. I.) and *Bætisca* (Pl. XXI.) there are perhaps five of them, whilst in most of the genera from *Coloburus* onwards, although the number of the adventitious nervures appears at first to be two, it seems reasonable upon closer inspection to recognize four of them, of which the third unites with the cubitus (5) to form a fork enclosing the fourth (4¹), in the same manner as the second and sector enclose the first.

Second Group.—The defection of the cubitus and sector from this group is compensated for by the transference of the anal (8) nervure to it. When adventitious nervures are interposed between the præbrachial and the pobrachial (they are absent in *Habrophlebia*, Pl. XIII.), they are more frequently associated with the former than with the latter nervure; and it sometimes happens that the hindermost adventitious nervure (6¹) in genera related to *Siphlurus*, assumes equality with, or even predominates over, the præbrachial (6). The adventitious neuration intervening between the pobrachial (7) and anal (8) is of meagre extent when it is not suppressed.

Third Group.—The axillary nervures (9), usually left behind by the anal (8), generally occupy a very limited space in the hind wing; they attain their highest development in *Chirotonetes* and *Oniscigaster* (Pl. XIX. & XXI.).

The legs present great differences in their condition, in the relative lengths of the several pairs, and in the proportions of the component parts of corresponding pairs. Some of these differences are sexual, others are generical. Sometimes all of the legs are functionless,—flaccid, filamentary rudiments of the tibiæ and tarsi, or else atrophied miniatures of the same, definitely shaped, but thoroughly infirm, remaining attached to the femora; in other instances such is the condition of only the two hinder pairs, and then the anterior pair may be either stout and short, or slender and long in either the male only, or in both sexes. The fore legs are always longer in the male than in the female (usually very much so), and are generally longer than either of the hinder pairs; but in the male of *Oligoneuria* the fore leg is shorter than the intermediate. The hind legs are usually as long as, or shorter than, the intermediate; but in *Adenophlebia* the middle pair is the shortest of all. The prolongation of the fore leg is chiefly due to the lengthening either of

the tarsus, or of the tibia, or of both of them; but in the other legs it is generally brought about by extension of the tibia and femur. The fore tarsus is often as long as the tibia; indeed in the male it frequently is much longer than it: the hinder tarsi are usually shorter, and only in a very few forms are they longer than it (*e. g.* in *Bætisca*, where the proximal joint of the tarsus by itself is as long as the tibia). The maximum number of tarsal joints is 5; the apical projection of the tibia which, in some genera, forms a basis for the insertion of the fore tarsus of the male, resembles at first sight a sixth joint, but it conforms in colour to the tibia and not to the tarsus. All of the tarsi may alike have five joints, or the fore tarsus may be five-jointed, while the others have only four distinct joints, and a very ill-defined trace of the fifth; or all of them may have only four joints: in atrophied legs, however, the tarsi of the hinder legs may be two-jointed, or even jointless. The ungues of the fore tarsus are sometimes both alike in form and size; but this is often not the case: the same may be said of the ungues of the hinder tarsi, which further may resemble or differ from the ungues of the fore tarsus in form.

The forceps of the male (specialized legs of the ninth abdominal segment) are seldom jointless (*Cænis*, *Campsurus*, &c.), but are usually two-, three-, or four-jointed, with the basal joint or the next the longest. In some genera they afford good distinctive characters of species.

Much diversity is exhibited in the number and relative proportions of the caudal setæ. They are often all of one length; but the median seta is occasionally a little longer or a little shorter than the others, sometimes considerably shorter, frequently atrophied to a mere rudiment, and in many instances altogether cast off. The outer setæ are always persistent (in the absence of accident), and either many times exceed, or else equal or fall short of, the body in length, according to sex or genus. The setæ are commonly glabrous, or almost so, seldom pilose or plumose: their component joints, transverse in the basal portion, assume a more elongated form in the distal portion of the seta, where in some cases they attain rather attenuated dimensions.

Habits of the Flies.

The popular supposition, that Mayflies are strictly ephemeral, is fallacious in most instances. It is true that the adult insect cannot eat, owing to atrophy of its mouth-organs and to the condition of its alimentary canal; but, provided that the air be not too dry, the imagines of many genera can live without food several days. Tradition states that Curtis kept a female *Cloëon* alive three weeks; this is an exceptionally long period, for in general an individual in confinement becomes perceptibly shrunken within three days, and is dead by the fourth day, if not before. Apparently there is some correspondence between the length of time spent in the subimago stage and the duration of the life of the imago: when the former amounts to twelve or twenty-four hours and upwards, the latter lasts more than a day; but when the change into imago takes place within a few minutes of the insect's quitting the nymph skin, its life is fugitive, passing away in the course of the evening or early morning. In some genera of short-lived Ephemeridæ the subimago skin is partially or altogether persistent in one or other of the sexes; and such

portions of it as may be shed are moulted while the insect is in full flight. Thus the males of *Oligoneuria* retain the pellicle in question upon their wings (the slough that may often be seen still dangling from their tails comprises exuviæ of the body, legs, and setæ only), whilst the females of *Palingenia*, *Campsurus*, and some others, seem to throw off none of it at all. The males of these restless creatures have their hinder legs either atrophied or too feeble to support the body, and in most of the females the fore legs also are equally infirm and functionless. The longer-lived flies issue from the nymph-skin in a rather less matured condition than the others; their legs are always serviceable in both of the sexes; and the subimago skin is always completely cast. The change from nymph to subimago is effected while the insect is floating at the surface of the water, buoyed up by gas which has accumulated within the alimentary canal and between the new and the old integuments of the body. The moult having been transacted in the ordinary manner, the subimago, standing upon the water with the wings erect, awaits a favourable moment for flying to shelter. Fluttering steadily upwards it mounts aloft, sometimes to a considerable elevation, presently making its way to trees, walls, or herbage, &c., likely to afford it a suitable resting-place. There it assumes the posture characteristic of its genus during repose. It may stand either upon all of its feet, or upon only the two hinder pairs; and the fore legs extended in advance, off the ground, may in this last case be held either close together or else apart from each other. The caudal setæ, in most instances divergent, are sometimes placed alongside of one another horizontally, or slanting upwards.

Adult diurnal Ephemeridæ, in hot weather, seek repose during the heat of the day, limiting their flight to the cooler hours of sunlight, or, at most, extending it later in the evening till just after sunset. In cold disagreeable weather they seldom fly at all, but remain under shelter. Many persons are familiar with the mode of flying habitual to some of the more conspicuous Mayflies (especially the males), which, by the intermittent action of the wings, results in a dance-like motion almost vertically up and down,—a fluttering swift ascent, and then a passive leisurely fall, many times repeated. The body during the rise is carried in a position very little out of the perpendicular, with the legs extended upwards in advance, and the setæ trailed behind; and this is the posture maintained by *Heptagenia* and its allies (only their setæ are divergent) whilst hovering head to windward, which has led to their being locally designated in the valley of the Axe (Devon) "Yellow Uprights." During the descent, the body, less steeply inclined, is steadied by the half-spread motionless wings and the outstretched setæ and legs. The males of *Cænis* sometimes jerk themselves downwards impetuously in their dance, instead of subsiding without effort; and the females of *Ephemerella*, while flying horizontally onwards, have a habit of dipping frequently in their flight. Conspicuous objects near water, such as roads, hedges, and shrubs, as well as the streams inhabited by the nymphs, are favourite rendezvous of the dancers, and therefore good sites for collecting the adult flies. In mountain-glens and wooded ravines prominent light-coloured rocks often serve to attract them; but frequently in such situations their diversions proceed beyond the range of the net. When this is so, it is advisable to watch for subimagines rising from the water, and carry them home alive in bottles, to undergo their moult. The bottles must be kept cool, and neither very dry inside nor visibly damp; and it is sometimes necessary to place

within the bottle a piece of paper, secured from shaking about, to afford foothold to the captives. A woollen wrapper round the bottle, and three or four drops of water upon the paper, meet these requirements; and in very warm weather the bottles can be carried in a mat basket. Subimagines of certain genera issue only at particular times of the day; as a rule, the afternoon and evening are the best periods for collecting them. In the morning specimens harbouring amidst branches of shrubs and trees overhanging streams can be procured by beating into the net. Nocturnal species may advantageously be looked for in spiders' webs, and on lamps, adjacent to rivers; and wherever such lamps happen to be close to white walls or placarded hoardings, numbers of specimens are apt to be attracted by the illuminated surfaces. Subimagines of *Baëtis* and sundry other genera may frequently be found clinging to *Sparganium* and grass at the borders of streams, a few inches above the level of the water.

Many species that fly by night appear on the wing before dark. They are most of them short-lived. The ordinary flight of *Oligoneuria* is rapid, the insects sweeping swiftly to and fro, far up and down the stream, with flurried bustling movements, very similar, indeed, to those of Leptoceridæ, the females for the most part close to the surface, and the males a few feet above it, while now and again a female hurries aloft pursued by a jostling throng of admirers amidst whom she very soon sinks down again encumbered towards the water. Upon occasion, however, they behave differently. During one or two nights only in the course of the season, in favourable weather, innumerable multitudes of these flies issue after sundown from the river, filling the air, like snowflakes in a storm, to a very considerable height (M. Albert Müller observed some at an altitude of 500 feet above the Rhine at Basle), and advancing steadily in one direction. Species of other genera, such as *Palingenia* and *Polymitarcys*, have a similar habit of swarming, and so also have certain kinds of *Ephemera* and *Hexagenia*. *Cœnis* has been observed in East Central Africa flying in dense clouds that resembled smoke in the distance.

Most of the Ephemeridæ couple during flight, the male lowermost. Darting at his mate from below, and clasping her prothorax with his elongated fore tarsi (whose articulation with the tibia is so constructed as to admit of supination of the tarsus) he bends the extremity of his body forwards over his back, grasps with his forceps the hinder part of her seventh ventral segment, and with his outer caudal setæ embraces her sixth segment. These two setæ exhibit near their origin a strongly marked articulation, where they can be deflected abruptly so as to lie forwards over the back of the female parallel with one another between her wings. Meanwhile the couple gradually sink, the female not being quite able to support herself and mate; and by the time they reach the ground, if not before, their connexion is usually terminated, although a pair of *Ecdyurus* has been seen by me to maintain union effectively as long as six or seven minutes after they had come to rest. Soon after their disengagement the male flies away to resume his interrupted gambols (being prone to polygamy), and the female after resting awhile repairs to the water to lay her eggs. Many of the females are polyandrous.

The male of *Palingenia* has very short fore legs; and he is mated, not in mid air, but upon the river amidst crowds of rivals, who pile themselves up upon him and his surroundings until he is overwhelmed by a large struggling mass of them floating down the

stream like a heap of foam, whose resting-place (in New Guinea, at least) is generally found in the mouth of a big fish. [See below, under *Palingenia papuana*.]

Oviposition and the Egg.

Oviposition is usually performed in fresh water; a Cingalese *Palingenia*, however, inhabits an estuary where the water occasionally must be brackish. Some short-lived species discharge the contents of their ovaries completely *en masse*, and the pair of fusiform or subcylindrical egg-clusters laid upon the water rapidly disintegrate, so as to let the eggs sink broad-cast upon the river-bed. The less perishable species extrude their eggs gradually, part at a time, and deposit them in one or other of the following manners:—either the mother alights upon the water at intervals to wash off the eggs that have issued from the mouths of the oviducts during her flight; or else (Eaton, Trans. Ent. Soc., London, 1873, p. 401) she creeps down into the water—enclosed within a film of air, with her wings collapsed so as to overlie the abdomen in the form of an acute narrowly linear bundle, and with her setæ closed together—to lay her eggs upon the underside of stones, disposing them in rounded patches, in a single layer evenly spread, and in mutual contiguity. This has been witnessed by me several times, and in the case of several species of *Baëtis*. The female on the completion of her labour usually floats up to the surface of the water, ineffectively swimming with her legs, and, on emerging, her wings all at once are suddenly unfolded and erected; she then either flies away, or (as often happens) if her setæ have chanced to become wet and cannot be extricated from the water, she is detained by them until she is drowned. In some instances, however, the female dies under water beside her eggs.

The eggs, indefinitely numerous, are diversiform according to the genus, some being subrotund, others elliptical. An appendage of various relative size is in certain cases present at one end of the egg; for example, in *Cænis* it is narrowly crescentic, but in *Ephemerella* it nearly equals the yolk itself in size, and forms in combination with it a somewhat figure-of-8-shaped mass.

The duration of the egg-stage varies with the temperature to which the eggs are exposed. Some of *Polymitarcys virgo*, kept in Dr. N. Joly's laboratory at Toulouse, were hatched about six or seven months after they were laid.

Professor L. Calori (1848) and Dr. E. Joly (1877) have recorded instances of larviparition observed by them in *Cloëon dipterum*. Although they supposed that the young were produced from impregnated eggs retained within the mother, perhaps for some weeks, it may be conjectured, with equal if not greater probability, that these were the produce of unfertilized ova advanced to maturity within the nymph and hatched as soon as she became an imago.

In the absence of elaborate contrivances, many Ephemeridæ can be bred in captivity if confined in flower-pot saucers, or other wide vessels, containing very little water, duly protected from extremes of temperature. If the bottom be glazed inside, it should be thoroughly strewn over with sand or fine river-gravel, that the insects need not die of fatigue in struggling to maintain their footing upon it. *Ranunculus* should not be

planted in the pans, because the sap exuding from its broken stems appears to be poisonous to these animals.

The Young of the Ephemeridæ.

The term "nymph" is employed in this work to designate all the subaqueous stages in the development of the young after it is hatched. The old-fashioned usage of "larva" and "pupa," borrowed from the terminology of other Orders to denote respectively the wingless and wing-budding grades of the nymph, seem scarcely worth retention; for they do not indicate precisely any definite epochs of particular importance in the life-history of these animals. Nymphs are young which lead an active life, quitting the egg at a tolerably advanced stage of morphological development, and having the mouth-parts formed after the same main type of construction as those of the adult insect.

Mayfly nymphs mostly feed upon either mud or minute aquatic vegetation, such as covers stones and the larger plants; but (judging by their mandibles and maxillæ) some must be predacious. Many of them live in concealment in the banks or under stones in the bed of streams, rivers, and lakes; others ramble openly amongst water-weeds and swim with celerity. Certain genera are restricted exclusively to large rivers; and one of these (*Palingenia*) is said to remain a nymph three years. *Cloëon* (*teste* Sir John Lubbock) moults twenty-three times, and is probably bred much more expeditiously than *Palingenia*; it is one of the genera found in streams, ditches, and ponds, or the shallow parts of lakes.

Besides the influence of flood and drought, or constancy of supply, the climate of the water is largely concerned in determining the fitness or unsuitability of a particular site for particular kinds of Ephemeridæ. A knowledge of the water-climate needed by a species renders intelligible the limitations of its geographical and local distribution. The temperature of the ordinary land-springs in a district enables the climate of other water in that neighbourhood to be ascertained readily by comparison with it. If the water of a given site exhibits marked differences in temperature from the standard of the neighbourhood, according to the season or the time of day, its climate is extreme, and the site cannot be inhabited by species which require relatively cold water.

The newly hatched nymphs are destitute of any visible muscular, nervous, circulatory, or reproductive system; their alimentary canal is incomplete; and, being too small to require special breathing-apparatus, they respire through the integument at large. The abdomen is 9-jointed, and the antennæ and caudal setæ have likewise fewer articulations, and are less hairy than those of more advanced nymphs. *Polymitarcys* possesses the third caudal seta even before it is hatched; but *Cloëon* is born without any trace of it, and develops it gradually at a later period (Joly and Lubbock).

During the first few days after their birth the young cast their skin several times, the intervals between the moultings lengthening by degrees (Lubbock). Blood-globules and rudiments of the tracheal branchiæ begin to appear simultaneously when the insect is eight or ten days old; the latter bud forth from the hinder lateral angles of some of the abdominal segments, and (like the parts of the mouth) are modified considerably in detail before they acquire their ultimate shapes (Joly).

Adolescence is evidenced by the advancement towards maturity of the reproductive organs internally, and externally by the outgrowth of rudimentary wings from the hind borders of the proper segments. The forceps of the male also begin to bud forth, and in certain genera an extension of the apical integument of the penultimate ventral segment becomes perceptible in the female.

Characters and Peculiarities of the Nymph.—In their general form most nymphs nearly resemble the adult. *Prosopistoma* is exceptional in having the body oval in outline, convex above and flattened beneath; and it possesses the faculty of adhering firmly by suction, like a limpet, to stones. A N.-American ally of *Ephemerella* (Pl. XXXIX.), longer in the body than *Prosopistoma*, is furnished with concavities on the pectus and venter that are densely pilose, which appear to afford it a similar power. Many other genera have the body of the nymph dilated and flattened beneath more than it is in the imago, but not with any view to its employment as a means of adhesion.

Head diversiform, prominent, usually about as wide as the thorax, vertical or else protense; cranial sutures mostly distinct. Labrum (when present) transverse, emarginate in front, and rounded off at the anterior corners; when it is absent, a velvety fold of the palate-membrane completes the enclosure of the mouth opening immediately above the mandibles at a distance from the edge of the epistoma. Frons usually even, but sometimes (e. g. in *Ephemera*) produced into short projecting points. Ocelli three, small. Oculi moderate, becoming large in the adolescent male. Antennæ slender and tapering (their first two joints the stoutest), usually many-jointed and long, but sometimes few-jointed, very short and subulate; in many genera the joints are nearly bald, whilst in others (e. g. *Ephemera*) they are beset near their tips each with a whorl of long spreading hair. Mandibles strong, with more or less asymmetrical dentition, which comprises usually a molar surface in addition to fang-like lobes; but in some predatory genera (Pls. XLIII. & LIII.) the molar region is wanting. The endopodite is often represented by a slender jointless movable appendage attached to the inner base of the inferior lobe (as in *Siphlurus*, Pl. L.), or sometimes by a tuft of hair (*Ecdyurus*, Pl. LXII.). The lobes are remarkably abrupt in *Baëtis* (Pl. XLIV.). The outer lateral region of the mandible in a *Palingenia* from Ceylon (Pl. XXV.) is produced into a massive enlargement continuous with the crown; in *Potamanthus* it is armed with a tooth-like tubercle (Pl. XXXI.); in *Polymitarcys*, *Ephemera*, &c. it is extended into a strong tapering tusk, distinct from the crown, variously furnished outside with tubercles (Pls. XXVIII. & XXX.); this prolongation is more slender in *Euthyplocia* and densely hairy (Pl. XXIX.). First maxilla unaccompanied by a galea, its inner edge generally either hairy or rigidly setulose, but sometimes spinose, the point often pungent, the crown variously armed, sometimes with long fine hair distributed evenly upon it (*Oligoneuria*, *Polymitarcys*, Pls. XXVI.–XXVIII.), sometimes with a dense beard of harsh hair, as in *Habrophlebia* (Pl. XXXVI.), at other times with pectinate spinules, as in *Chirotonetes*, *Rhithrogena*, &c. (Pls. XLIX., LIV., &c.). Palpus of first maxilla usually 2-, 3-, or 4-jointed, according to the affinities of the genus [but in one instance multi-articulate (Pl. LIII.)], and of various relative length,—extremely long in *Euthyplocia* (Pl. XXIX.), very short in *Ephemerella* and its kindred (Pls. XXXVII.–XL.).

Second maxillæ, when present (in *Oligoneuria* they are either suppressed, or else are reduced to the condition of raised folds traversing the upper surface of the labium, Pl. XXVI.), simple and usually flattened; palpus 2-jointed in allies of *Palingenia* and *Ecdyurus* (though in this latter group of genera the last joint may essentially be compounded of two), 3-jointed in most other instances, but in one remarkable case (Pl. LIV.) multiarticulate; it usually tapers towards its extremity, but is sometimes enlarged or expanded, whilst in *Bætisca* (Pl. LII.) it is actually forcipate. Labium in the large majority of genera plane and bipartite, with lobes as large as, or smaller than, the laciniæ of the second maxillæ. In a few cases it is undivided, and is then either plane and creased lengthwise through the middle (*Oligoneuria*, Pl. XXVI.), or else is conduplicate (*Palingenia*, Pl. XXV.; *Polymitarcys*, Pl. XXVIII.). Tongue (glossa) and paraglossæ membranous or pergamentose, the former usually inflated and often concave in the middle, generally broad, and either as long as or shorter than the paraglossæ. The following are their leading modifications:—paraglossæ broad; tongue ovate (Pls. XXV. & XXVI., *Palingenia* and *Oligoneuria*), subrotund (Pl. XXVII. *Jolia*), oblong and entire (Pl. XXXIII. *Blasturus*), emarginate (Pls. XXIX. & XXX., *Euthyplocia* and *Ephemera*), obcordate (Pl. XXXI. *Potamanthus*), retuse, with claw-like lateral projections (Pls. XXXIV. & XXXV., *Choroterpes* and *Thraulus*), mucronate, and in combination with the paraglossæ rather like a mitre or a biretta seen broad-wise (Pls. XLV.–XLVII., *Baëtis* and allies):—paraglossæ narrow and recurved, tongue broad and bifid (Pl. XXXVI., *Habrophlebia*). In some genera both glossa and paraglossæ appear to be absent; *Prosopistoma* seems to have none.

Thorax compact or subcompact, rigid; pectus rather broad; prothorax usually well developed and more distinct than the metathorax from the mesothorax; but in *Bætisca* and some few other genera (Pls. XLIII., LII.) the pronotum is intimately blended with the mesonotum. *Ecdyurus* and many of its kindred have the head and pronotum bordered at the sides with a membranous expansion seemingly subservient to the oxygenation of intratracheal air. The wingpets of advanced nymphs are united by their inner margins to the apical borders of their proper segments, and overlie the base of the abdomen. In nearly mature nymphs of *Oligoneuria* (Pl. XXVI.), and in even less aged specimens of genera related to *Ephemerella* (Pls. XXXVII.–XL.), the space included between the terminal margins of the fore wings and the peak of the mesonotum becomes closed over by a membrane in continuity with the same, extending almost up to the extremities of the wings. This membrane is produced backwards still farther in *Prosopistoma* and *Bætisca* (Pls. XLIII. & LII.), so as to form in combination with the wings a hood which completely roofs over the tracheal branchiæ and the segments that bear them. Formerly the construction of this shield was not quite understood, the whole of it being attributed to hypertrophy of the mesonotum; but one of Dr. Hagen's gifts of specimens furnished the means of explaining its composition rightly. Coxæ usually prominent, but not so in *Prosopistoma* (*l. c.*). Trochanter short and strong. Femora moderately or very stout, sometimes much compressed. Tibiæ spurless, though in a few instances terminating in a point or spine; often apparently compound owing to the distinctness of an oblique line of muscular insertion perceptible below the knee. Tarsi

2-jointed, the terminal joint claw-shaped. The legs, as a whole, are modified to suit the habits of the nymph: the hinder pairs of burrowing nymphs are often short and weak, whilst their fore legs are strong (e. g. *Polymitarcys*, Pl. XXVIII.); the fore tibiæ and femora of many such nymphs also are often strongly bearded with long stiff hair. In *Prosopistoma* the corresponding armature is a row of minute pectinate spinules. Different nymphs have different manners of disposing their legs whilst swimming, according to their kindred; those which swim laboriously and slowly keep theirs at work as if they were running, without much effect. *Heptagenia* and its allies employ their flattened femora to some advantage; others, such as *Cloëon* and its associates, trail their legs at length through the water, darting swiftly about, propelled solely by their caudal setæ; but the legs of *Prosopistoma* (which is just as nimble as the nymphs last referred to) are folded up closely beneath the thorax, which is grooved for their reception. The legs of dead specimens in fluid are often set out in the postures appropriate to them during natation.

Abdomen sessile, differing considerably in length relatively to the head and thorax, according as the anterior segments are or are not abbreviated in comparison with the hinder ones; in cross-section it is either subcircular, or arched above and flattened beneath. The hinder lateral angles of some of the segments are in many genera prolonged backwards into acute teeth of diverse dimensions. From the last segment just below the tergum issue two or three many-jointed caudal setæ of various lengths in proportion to the body; sometimes they are much longer than it (*Heptagenia* &c.), at others unequal to it, while in a *Palingenia* from Ceylon and a few other genera they are many times shorter than it. The median seta is in some instances the shortest or even abortive, and in many more is eventually deciduous at the penultimate moult through atrophy. Throughout more or less of their extent, on one or on both sides, their hair is usually lengthened so as to feather them and render them fit to serve as organs of propulsion. The outer tails can be moved at will towards or away from the median tail; and the amount of their natural divergence from it during repose is an item of importance in classification. In *Prosopistoma* the setæ can be simultaneously retracted into the abdomen so as to be entirely hidden.

Tracheal branchiæ are movable, membranaceous, or filamentose appendages to the integuments, enclosing branching tracheæ, which are deciduous with the epidermis, and are media for the oxygenation of the systemic air distributed throughout the body. It is usual to assert that the insect employs them as fins; but however rapidly it may agitate them to and fro, they do not seem to increase its rate of progression. They are principally outgrowths of some or all of the first seven abdominal segments, and arise from only one region of the same segment at a time; but the point of origin need not be the same in consecutive segments. In the large majority of genera their places of attachment are latero-dorsal, and then either well in advance of the posterior angle of the segment (*Palingenia*, *Leptophlebia*, &c.), or at the apex of the angle, or else at the hinder border of the segment, within a sinus at the base of the lateral tooth-like prolongation of the same. The first abdominal pair in *Oligoneuria* and *Rhithrogena* is latero-ventral instead of dorsal; and in the former genus, as well as in *Jolia*, one pair is

cephalic, issuing from the basal joinings of the upper maxillæ. *Jolia*, in addition, has a branchial tuft at the insertion of each of the fore legs. The abdominal pairs are usually all exposed, and are carried diversely in different genera; their form, proportions, and substance likewise vary more or less, not only with their serial position in the same insect, but also with the genus. In *Bætisca* and *Prosopistoma* all of them are concealed by the shield already described in connexion with the thorax; in other cases one pair is enlarged and thickened so as to resemble elytra covering the pairs posterior to it (Pls. XL.–XLII.). Several fossorial nymphs dispose their tracheal branchiæ in an arch over their backs; in other kinds they are decumbent upon the dorsum; in others they are directed outwards and backwards from, or are held at right angles with, the sides of the body; in *Rhithrogena* some are deflected, and two pairs underlie the venter. As to their forms, when foliaceous they may be subquadrangular, subrotund, oval, ovate, spatulate, lanceolate, or linear, with their margin entire or fringed, or in part croso-crenate; they may be digitate, pinnatisect, laciniate, or dissecto-fimbriate; and in many of these alternatives they may be single or binate, plane or conduplicate. Sometimes they are compounded of dissimilar elements, as when a tracheal branchia consists of a foliaceous membrane, furnished at its base with an explanate or fasciculated tuft of simple or branched filaments (Pls. LIV.–LXII.); or as in *Ephemerella* and its kindred, where each is composed of a coriaceous lamina sheltering a binate appendage of imbricate lamellæ disposed in the form of the letter V; or again, as in what may be *Tricorythus* (Pl. XLI.). In the matter of proportional size, the tracheal branchiæ of the first abdominal segment (when they are developed at all) are frequently minute (*e. g.* in *Cænis* and *Ephemera*); the last pair is usually small; the second pair is the largest in *Cænis*, the third or the fourth pair in many others; but very often all of them are much alike in size. The substance of tracheal branchiæ with the margin entire is stronger than that of others whose form is less simple, being usually more or less coriaceous or corneous. When they are unusually stout their hinder or under surface is lined with delicate membrane, upon which the tracheæ are distributed. Most of the tracheal branchiæ are kept in rapid agitation; but the first and the last pairs, and in *Cænis* the elytroid pair, are usually held almost motionless.

The branchial tracheæ branch in a manner very similar to that of the ribs and veins of dicotyledonous leaves of like form. They should be examined (when this is possible) while the insect is yet alive, because very soon after death endosmosis drives the air out of their ultimate subdivisions, which cannot then be seen. More than one skilled anatomist, trusting to inspection of cabinet examples placed in preservative fluid, has denied the existence of tracheæ within filamentose tracheal branchiæ, being unaware of the rapidity and completeness of their obliteration in the dead insect under ordinary circumstances.

Tracheal respiration is apparently carried on to some little extent by means of other organs than the regular tracheal branchiæ in certain instances. The rectum, the expanded borders of the head and front portion of the thorax in *Ecdyurus* and its allies, the hinder surface of the femur in these and some other genera, and perhaps the caudal setæ, may be taken as examples of such accessory organs.

In some genera the body and limbs are partially clothed with hair. This is generally simple; but *Ephemerella* and some kindred nymphs have clavate hairs in certain regions, closely resembling in their spinulose structure the thickened hairs of sundry Trombidinæ; and some of the pubescence on the head of a Cingalese *Palingenia* is microscopically plumose. The figure of the mandible of *Prosopistoma* (Pl. XLIII.) is not on a scale of enlargement sufficient to show the plumose structure of the bristles adjacent to the endopodite.

The term 'Subimago' is used to denote the penultimate stage in the life of such of the Ephemeridæ (the large majority of them) as moult once after direct respiration through the stigmata has been established, and their wings have become fully expanded. The chief points whereby insects in this condition can generally be distinguished from adult examples are—the dulness of the integuments, especially that of the wings; the ciliolate terminal margin of the wings in many genera; the brevity of the fore legs; the greater hairiness and shortness of the caudal setæ; the less protuberant and less brightly coloured oculi; and, in the male, the marked shortness and stoutness of the limbs of the forceps. Where (as in *Cœnis* and *Tricorythus*) the wings are ciliolate both in the subimago and in the adult, and where (as in *Polymitarcys*) the wings are opaque in both stages, account has to be taken of the remaining criteria. In some genera the thorax of the subimago differs in its markings from that of the adult fly, and the wings undergo changes in their coloration before the last moult. When the subimaginal slough is retained upon the wings of the adult fly (as in *Oligoneuria*) they remain dull and subopaque during life.

The term 'Pseudimago,' employed by a few authors instead of Subimago, is an etymological solecism derived from two words belonging to different languages. 'Pseudidolum,' or 'Proidolum,' would be the Latinized Greek equivalent of the Latin Subimago, if any were needed.

Characters which have been used as Bases of Classification, but which are not fundamental.

Many of the characters upon which the classification of the Ephemeridæ was formerly based have proved to be unsuitable for the purpose. Originally the *number of the caudal setæ* was deemed a matter of primary importance; and when forms were discovered with the median seta abbreviated, they were ranked between those with three long equal setæ and those with two only. Subsequently, in addition to the setæ, *the number of the wings* was employed as a leading clue to the arrangement of the genera. But it is now well known that these criteria are serviceable at the most for nothing more than the distinguishing of genera very intimately related to each other, belonging to various subordinate alliances comprised within the family; while one of them (the number of the setæ) is not always available for even this purpose, varying as it does in some forms with the sex (*Polymitarcys*), or with the individual (*Atalophlebia australasica*). In more modern times *the comparative scarcity or abundance of cross veinlets* in the wings, and *especially in the marginal area of the anterior wing before the nodus*, has been supposed to furnish a trust-

worthy guide to the succession of the genera; but it is unequal to the actual requirements of the case; compare, for example, the fore wing of *Baëtis Salvini* (Pl. XVI. 29 *a*) with that of *Cosmetogenia* (Pl. XXIII. 42). The most recent suggestion as to the classification of the genera was to group them according to *the structure of the tracheal branches of the nymphs*. According to this scheme *Habrophlebia* (Pl. XXXVI.) and *Thraulus* (Pl. XXXV.) would fail to come into the same group as *Choroterpes* (Pl. XXXIV.) and *Blasturus* (Pl. XXXIII.). Indeed if dependence be placed implicitly upon the modifications to which this organ or that is subjected in the adult, or in the junior conditions of the insect, the scheme of classification arrived at can hardly fail to be unnatural and arbitrary. It is only by taking cognisance of points of difference and agreement in many details, in the anatomy and the mode of development and the habit, of leading representatives of the various alliances of genera, at different periods of their lives, before and after their exclusion from the egg, that the mutual affinities of the several associations of genera to one another can be demonstrated adequately. Until such comparisons can be and shall have been carried out, the whole question of their arrangement can only be dealt with in a tentative and experimental manner; and it will be fortunate if error be avoided in the necessary grouping of the genera into provisional alliances of apparently kindred forms, preparatory to the study of their affinities. It is far more easy to demonstrate defects in proposed methods of classification than to devise a trustworthy system in their stead; and possibly extended observation in the future may eventually show that some of the bases of arrangement adopted in this present work are mere temporary expedients worthy of mention in this paragraph.

History of the Classification of the Ephemeridæ.

The species of Ephemeridæ known to Linné were arranged by him in two sections of one genus *Ephemera*, according to the number of their caudal setæ—species with three, and with two setæ, respectively.

No further subdivision of the family was attempted until the year 1815, when Leach separated the latter of Linné's sections into two genera, *Baëtis* with four wings, and *Cloëon* with two. In the hands of subsequent entomologists these two genera became obscured by the interpolation of extraneous forms. To *Baëtis*, Say referred sundry species of *Hexagenia* and *Heptagenia*, as well as a *Bætisca*; and eventually this name was diverted altogether from the original type, and was misapplied by general consent to species of *Heptagenia* and *Siphlurus*.

Curtis, in 1834, proposed another genus named *Brachycercus*, like *Cloëon* deficient in hind wings, but distinguishable from it by its having three setæ. This name was suitable for the female insect only, with which sex alone he was acquainted.

Stephens, in 1835–6, possessing males of *Brachycercus*, finding them differ in very obvious particulars from Curtis's definition of the genus, and failing to perceive that their points of difference were of merely sexual character, established a genus *Cænis* with two sections, species with three long setæ, and species with three short setæ, a section for each sex. He also transferred the genus from the position after *Cloëon* previously assigned to it, to the end of the section of Ephemeridæ with three setæ.

Burmeister, in 1839, based his arrangement of the genera primarily upon the comparative scarcity or abundance of cross veinlets in the wings, and employed as secondary characters the conditions of the oculi, ocelli, tarsi, and setæ. He, too, renamed the genus *Brachycercus* of Curtis, calling it *Oxycypha*. Merging Leach's *Cloëon* and *Baëtis* together under the shorter form of the first name (*Cloë*) he regarded them as mere sections of this. The appellation *Baëtis* was misapplied by him, the first of the two series of species designated by it being equivalent to the unrestricted *Potamanthus* of Pictet (probably his materials were dried specimens defective in setæ), the second series (with one exception) to *Heptagenia*. He founded a new genus (*Palingenia*) for the reception of some species of the comprehensive *Ephemera* of early authors, distinguished by their possessing a distinct median ocellus and four-jointed tarsi, in lieu of an obsolescent median ocellus and tarsi almost five-jointed (the fifth or basal joint being intimately adnate to the tibia and ill-defined). These genera were arranged by him in the same sequence as that in which they are mentioned in this paragraph.

Professor Westwood, in 1840, established a genus *Leptophlebia* for some small species of the "Ephemera caudâ trisetâ" series of early authors, and unknowingly revived the real genus *Baëtis* of Leach, under the name *Brachyphlebia*. From allusions to Burmeister's genera in the Addenda to the Generical Synopsis, he appears to have become acquainted with the 'Handbuch' while the 'Introduction' was in the press, too late for a place to be assigned to *Palingenia*. From consideration of the number of the wings and setæ, and the structure of the nymph, he drew up the following arrangement of the genera:—*Ephemera*, *Leptophlebia*, ‡ *Baëtis* (= *Heptagenia*), *Cœnis*, *Cloëon*, and *Brachyphlebia*.

The scheme propounded by Pictet (1843–5) was constructed to a large extent with reference to the abundance or the paucity of cross veinlets in the anterior wings, the condition of the oculi in the male, and the number or the relative proportions of the caudal setæ. In the main the order of succession deduced from these data agrees with that which is arrived at when the genera are grouped according to the general habit of their nymphs (so far, at least, as he had been able to ascertain this), viz.:—Burrowing nymphs, creeping nymphs, and nymphs that swim with agility. The sequence of the genera is:—*Ephemera*, *Palingenia* (= *Polymitarcys*, *Hexagenia*, *Campsurus*, and the restricted *Palingenia*), ‡ *Baëtis* (= *Heptagenia*, and a species of *Atalophlebia*), *Potamanthus* (= the restricted *Potamanthus*, *Leptophlebia*, *Habrophlebia*, and *Ephemerella*), *Cloë* (= *Baëlis*, *Centroptilum*, *Callibætis*, and *Cloëon*), *Cœnis*, and *Oligoneuria*. Pictet foresaw that some of the species referred by him to the genera *Palingenia* and *Potamanthus* would probably prove to be incongruous, but was precluded by lack of materials from verifying his suspicions. He also surmised correctly that the neuration of the anterior wings in detail would furnish characters towards their discrimination, adding:—"Mais j'ai répugné à entrer pour cela dans une analyse aride, longue et minutieuse; j'ai craint de rendre plus difficile encore l'intelligence des descriptions;" but he did not attach much importance to the tarsal characters. If he had known of the name of *Leptophlebia* in time he would have used it instead of *Potamanthus*, although, as he remarks, this last is more comprehensive in its application than the former.

In 1862 an account of some Illinois species of Ephemeridæ was published by the late

Mr. B. D. Walsh. The classification of the genera was determined by an application of almost the same principles as were adopted by Burmeister, and is as follows:—‡ *Baëtis*, comprising three sections (Sect. A = *Siphlurus*; Sect. B = *Chirotonetes*; Sect. C = *Rhithrogena*); *Potamanthus* (= *Blasturus*); *Palingenia* with three sections (named by him in the following year: A, *Pentagenia*; B, *Hexagenia*; C, *Heptagenia*); *Ephemera*, *Ephemerella*, *Bætisca*; *Cloë* containing three sections (A = *Callibætis*; B = species of *Callibætis* and *Baëtis*; C = *Cloëon*); and *Cænis*.

Dr. Hagen, in 1863, used Pictet's genera in a revised order, alluding only incidentally to forms foreign to Great Britain:—*Oligoneuria*, *Cænis*, *Palingenia*, *Ephemera*, *Potamanthus*, ‡ *Baëtis*, and *Cloëon* (= *Cloë*).

In 1868 a systematic catalogue of genera with named types, and with notes on their geographical distribution, was published by me in the 'Entomologist's Monthly Magazine.' My attempts to describe the wings in an intelligible manner, in the absence of illustrations, were, to say the least, abortive. The genera stood thus:—*Cænis*, *Tricorythus*, *Oligoneuria* (with three sections), *Campsurus* (with two unreal sections), *Polymitarcys*, *Palingenia*, *Pentagenia*, *Hexagenia*, *Ephemera*, *Potamanthus*, *Leptophlebia* (with two sections), *Bætisca*, *Coloburus*, *Siphlurus*, and *Heptagenia* (with two sections).

In the same year, while describing the nymph of *Cænis*, I adduced reasons for transferring this genus from the position near *Baëtis* and *Cloëon*, assigned to it by Pictet (on account of the simplicity of its wing-neuration), to the neighbourhood of *Leptophlebia*, series 2 (= *Habrophlebia*), and likewise for the removal of *Oligoneuria*, ranked next after *Cænis* by Pictet, to the vicinage of *Palingenia*, changes that were carried out in my work on the Ephemeridæ in 1871, when a few minor alterations involving no principle in the succession of genera were also made.

The structure of the tracheal branchiæ of the nymph was taken as the basis of classification of Ephemeridæ by Dr. A. Vayssière in his 'Thesis' presented to the Faculté des Sciences de Paris, and published in the 'Annales des Sciences Naturelles' in 1882. He arranged the genera in five groups:—1, those having fringed branchial laminæ, *Leptophlebia* (= *Habrophlebia*), *Ephemera*, *Potamanthus*, and *Polymitarcys*; 2, those with laminæ devoid of fringes, *Oniscigaster*, *Cloëopsis* (= *Cloëon*), ‡ *Cloëon* (= ——?), ‡ *Centroptilum* (= *Bætis*); 3, those with simple laminæ furnished at the base with either a tuft of fibrils, *Heptagenia* (= *Ecdyurus*), *Oligoneuria*, *Jolia*, or a bifid appendage bearing very delicate imbricated lamellæ, *Ephemerella*; 4, those whose second pair of branchia afford protection to the following pairs, *Tricorythus* and *Cænis*; 5, "les larves dont l'appareil respiratoire est complétement caché et protégé par des prolongements mésothoraciques dans l'épaisseur desquels naîtront plus tard les ailes supérieures," *Bætisca* and *Prosopistoma*. I examined and named the type specimens of this Thesis at Avignon in August 1880; but the indications affixed to the phials appear to have become confused. To the best of my recollection the specimens representing ‡ *Cloëon* were junior examples of something which I suspected might be *Centroptilum* or *Baëtis*; but I did not ascertain which.

The additional knowledge of Ephemeridæ gained since 1871 has not yet necessitated any material departure from the sequence of the genera which I adopted. A few minor

alterations have been made (such as the establishment of genera in place of provisional sections) and a remarshalling of the members of certain alliances; and besides this, some genera, then isolated, have become rallying-points of new alliances; but these changes have not disturbed the scheme as a whole. The plan upon which it has been drawn up may be described as based upon conclusions derived from comparisons of adult insects checked and modified by others educed from the study of younger specimens. The general effect of this plan has been to bring into the middle of the series genera of hardy habit, that moult completely at the last ecdysis, that have functional legs with four distinct tarsal joints, and have the oculi of the adult male either bipartite or ascalaphoid. The ends of the series are occupied by genera that have the oculi of the ♂ furrowless and undivided, those having weak or functionalless hinder legs with at most four distinct joints to the tarsus, whose eggs are discharged in bulk, and whose life is truly ephemeral, commencing the series; and those whose legs are all efficient with five distinct joints to the tarsus, whose oviposition is gradual, whose life in the adult condition is measured by days, if it attain its full natural term, and whose last moult is complete, bringing the series to its close. The scheme is open to objections attendant upon all linear arrangements in zoology, individual genera here and there having to be ranked in groups with whose formulated definitions they are largely at variance during some portion of their existence. The subjoined Table exhibits the system of classification; generical details of the adult flies are illustrated in the first 24 plates, and the numbering of the genera quoted in the Table accords with the numerals assigned to them in the writing of those plates.

Table of the Classification of Genera of the Ephemeridæ numbered as in Plates I.–XXIV.

Family EPHEMERIDÆ.

Group I.

Series I.

Section 1 of *Palingenia* ..... Genera 1–6.

„ 2 of *Polymitarcys* ..... „ 7–10.

Series II.

Section 3 of *Ephemera* ..... Genera 11–13.

Group II.

Series I.

Section 4 of *Potamanthus* ..... Genera 14–15.

Series II.

Section 5 of *Leptophlebia* ..... Genera 16–23.

„ 6 of *Ephemerella* ..... „ 24, 24 *bis* &c.

Series III.

Section 7 of *Cænis* ..... Genera 25, 25 *bis*, 26.

„ 8 of *Prosopistoma* ..... „ 27.

Serie IV.

Section 9 of *Baëtis* ..... Genera 28–31.

Group III.

Series I.
Section 10 of *Siphlurus* ..... Genera 32–36.
„ 11 of *Bætisca* ..... „ 37.

Series II. (provisional).
Section 12 (provisional) ..... Genus Plate LII.

Series III.
Section 13 of *Atopopus* ..... Genera 38–40.
„ 14 of *Ecdyurus* ..... „ 41–46.

It may be noted of the foregoing Table that the composition of the section of *Polymitarcys* is not altogether homogeneous. Genus 7, *Euthyplocia*, may eventually have to rank as a separate section, on account of its triarticulate palpi.

Section 8 is associated in the same series as section 7, because the adult *Prosopistoma* ♀, in the construction of its head and thorax, is, according to M. Vayssière's representation, very similar to *Cænis*. This last genus, in some particulars, resembles insects of the *Polymitarcys* section; but, on account of the formation of the nymph, it appears to be more nearly related to the section of *Ephemerella* than to the genera of section 2.

The provisional section 12 is classed in Group III. on account of the nymph having some resemblance to genera of section 10 in the form of the laciniæ of its lower maxillæ and the lobes of the labium. On the other hand, its hinder tracheal-branchiæ are constructed after the same plan as those of the genera in section 14. As a matter of pure conjecture, it may be suspected of belonging to section 13, of which no nymphs have hitherto been seen; only if such were the case, it is probable that the tibiæ would be somewhat shorter than they are in comparison with the tarsi.

Systematic Description.

Group I. of the Genera.

Adult.—At the fore-wing roots the anal nervure (8) meets the pobrachial nervure (7); the hinder tarsi, when not atrophied, have four distinct joints, and sometimes an ill-defined fifth joint intimately concrete with the tibia; ♂ oculi evenly contoured. *Nymph.*—Palpi of the 2nd maxillæ ("labial palpi") 2-jointed (except *Euthyplocia*, 3-jointed).

First Series of Group I.

Legs of the adult ♀ short in proportion to the body, and feeble, when not functionalless, through atrophy of the tibia and tarsus; the fore legs in both sexes of the subimago extremely short, and transversely rugose; hind legs of adult ♀ the longest pair. *Nymph.* Palpi of 1st maxillæ very stout, 2-jointed (except *Euthyplocia* 3-jointed) and curved.

Section 1 *of the Genera.*—Type of *Palingenia.*—Subcosta of the fore wing, when developed, retired within a fold of the membrane somewhat beneath the radius. In many genera the subimaginal pellicle of the wings is not shed at the last moult. Nymph fossorial or predatory; in those that are known the median lobe of the tongue is pointed.

Subsection A. Wing-neuration complete and plentiful; anal nervure (8) of the fore wing either sinuous, or else from the wing-roots to its fork nearly straight, and afterwards gently arched; axillary nervures short but strong; the first (9^1) annexed to the anal

nervure (8) at the wing-roots, the second (9^2) ending apart from it in the regular raised axillary fold or vessel; wing-membrane translucent and dull. Pronotum large, transverse, broader than the head, tumescent, arched behind. Setæ pubescent or minutely pilose, short in ♀, very long and divaricate in ♂. Forceps borne upon a deflexible laminar lobe prolonged from the distal ventral margin of the 9th segment, which is not represented in the ♀, the proximal joints of the limbs the longest. Lobes of the penis unarmed; orifice of the seminal duct subapical, and on the inner side of the lobe. Eyes of the ♂, large, oval, narrowly separated from each other; anterior ocellus much smaller than the hinder two. Fore tibia and tarsus densely rugose transversely; ungues in each tarsus unequal, and not quite alike. Nymph fossorial; the labium concave, its sides approximated to each other above; the tracheal branchiæ borne upon protuberances armed with single minute spinules, situated in or near the middle of the sides of their respective segments, and arched upwards over the dorsum; the hinder lateral angles of the segments not produced backwards. Fore legs stout, densely bearded with long hair on the femur and tibia; the tibia and tarsus compressed, the former oblique at the tip. Terminal margin of the fore wings free.

The single genus contained in this subsection is a composite one; but further materials are needed to enable the incongruous species to be completely dissociated from the type. They may be referred provisionally to three subgenera:—*Palingenia* (typical), Burmeister, containing European and Western Asiatic species; *Anagenesia*, containing Indo-Malay, and a Siberian species; and a nameless subgenus containing Brazilian species.

PALINGENIA, Burm. 1839; restricted Eaton, 1868.

Illustrations. *Adult* (details) Pl. I. & III. 1 *a*–1 *f* (whole figures), see citations under *P. longicauda*. *Nymph* Pl. XXV., see also citations of Swam., Gorové, and especially Corn. (1848) under *P. longicauda* (whole figures and details).

Subgenus Palingenia (typical).

Adult.—Præbrachial nervure (6) of the fore wing forked beyond the middle; two conspicuous sets of longitudinal nervures proceed in pairs to the terminal margin (at 4^1, and at 5 & 6). Fore tarsus of ♂ about twice and a half ($2\frac{3}{7}$) as long as the femur. Setæ 2, in the ♂ upwards of three times as long as the body, in ♀ about the same length as the body. Anterior thoracic spiracle gaping, large; aperture bivalvular, the lower valve the smaller, with concave margin; the upper valve sinuous, having a large salient obtusely rounded lobe projecting inwards in front of the tegulæ. Orifice of the posterior thoracic spiracle gaping, irregularly reniform with the sinus in front.

Nymph [after Cornelius].—Six pairs of abdominal tracheal branchiæ, each lamina fringed with short simple fibrils, and perhaps folded together lengthwise. Setæ about $\frac{1}{3}$ as long as the body in the female.

Distribution. Eastern N. temperate region.

Type. *P. longicauda* (in *Ephemera*), Ol.

Etymology, παλιγγενεα, in allusion to its annual swarming.

PALINGENIA LONGICAUDA, Oliv. Plate I. 1 *a* (wings, legs, ♂ ♀, head and forceps, ♂ adult).

Hemerobius, Clutius, Opusc. 2, cap. viii. (frontispiece), p. 100 (1634).

Ephemerum, Swam., Ephem. vita (1675); idem, ed. Tyson, p. 44, pls. i.–iv. and v. 2 (young); pl. v. 1, 3, &c., viii. [adult] (1681); Schæffer, Ic. iii. tab. cciv. 3 (1776). Ladislaus Gorové, alias Stefan Gosevé, in Tudomanyos gyiij temény, viii. [Egy kulonös tüneménynek, az úgynevezett Tisza viragzás nach leiraza], pp. 22, tab. 1, a–c (young), e (last moult), f (slough), g ♂, d ♀ im. [A very full account] (1819). Reprinted by Mocsáry, in Rev. d. Inhaltes der Termeszetrajze Furzetek, ii. 124–5, and (German-text) natür. historische, Heft ii. Bd. ii. u. iii. 181–2) (1878).

Ephemera longicauda, Oliv., Enc. Méth. vi. 418 (1791); Latreille, H. N. xiii. 96 (1805); Lamarck, H. N. ed. i. iv. 221 (1817); ! Ramb., Névropt. 295 (1842). *E. flos-aquæ*, Illiger, Mag. f. Ins. i. 187–8, no. 17 (1802); Treipke, Stet. ent. Zeit. i. 54–8 (1840). *E. Swammerdiana*, ! Lat., H. N. xiii. 96 (1805); idem, Gen. iii. 184 (1807); Cuvier, R. A. ed. I. iii. 430 (1817); ditto, ed. II. v. 244 (1829); Lamarck, H. N. ed. I. iv. 221 (1817); Blanchard, H. N. Ins. iii. 54 (1840); idem, in Cuv., R. A., ed. Crochard, xiii. 91 (1848). *E. Swammerdamiana*, Shaw, Gen. Zool. vi. part 2, pl. lxxxii. (1806).

‡ *Semblis marginata*, Panzer, in Explic. Schæf. Ic. cciv. (1804).

Palingenia longicauda, Burmeister, Handb. ii. 803 (1839); H.-Schæf., Fn. Ratisb. 346 (1840); Pictet. Nat. Hist. Névropt. ii. Ephém. 155, pls. xiv. xiv bis, xvi. (1843–45); Cornelius, Beitr. z. Kenntn. d. *P. longicauda*, pp. 38, pls. i.–iv. (1848); Walker, Cat. 549 (1853); Hagen, Stet. ent. Zeit. xv. 316–19 (1854); Perty, Die Zool., Th. ii. 344–45 (1855); Hag., Stet. ent. Zeit. xx. 431 (1859); Loew, Verh. zool.-bot. Ges. Wien, xi. 409–10 (1861); Corn., Stet. ent. Zeit. xxiii. 465–66 (1862); Gerstäcker, Handb. d. Zoologie, ii. 59–61 (1863); Karsch, Die Insectenwelt, v. 400–2 (1863); Eaton, Trans. Ent. Soc. Lond. 1871, p. 62, pls. 17–17 a (1871); Joly, Mém. Soc. d. Sc. Nat. Cherbourg. xvi. pl. i. 2 [after Swammerd.] (1872); Hag., Trans. Ent. Soc. Lond. 1873, pp. 385–86 and 392 (1873); N. & E. Joly, Rev. Sc. Nat. v. 10, and pp. 324–26, pls. vi. 2, ix. 39–41 (1876); Mocsáry [vide *Ephemerum*, Swam. &c. supra] (1878); Rostock, Jahresb. d. Ver. f. Naturk. Zwickau, 1877, p. 82 (1878).

Adult (*dried*) ♂.—Wings dull translucent brownish, of a tint intermediate between medium sepia and medium Cologne-earth, with opaque neuration and slightly yellowish wing-roots. The first of the subsidiary nervures contained within the fork of the anal nervure (8) is rather unstable in its arrangement. Setæ, venter, legs, and underside of the thorax light bright yellow, excepting the tibiæ and tarsi, which are very light brownish; the pronotum dull light waxy-yellow, the mesonotum slightly browner. Head pitch-black. Dorsum of abdomen intense sepia.

♀. Wings very slightly lighter than in the ♂. Pronotum, meso- and metanotum of a medium Cologne-earth brown, which colour borders the occipital margin of the vertex. Setæ light brownish yellow. Length of body, ♂ 23–25, ♀ 27·5–29; wing, ♂ 24–26, ♀ 31; setæ, ♂ 70–74 & 1·5, ♀ 26–27·5 mm.

Hab. The large rivers of middle Europe from Rotterdam to Hungary, also near Cette. This last locality is quoted on account of a nymph in the Museum of Comparative Zoology, Cambridge, Mass. According to Mr. Snellen of Rotterdam, Swammerdam's statement that this species appears in vast multitudes during one or two evenings only every year, "on or about the Feast of St. John," is generally correct, but the date of the swarm is liable to be earlier in warm seasons, sometimes as early as the 10th of June.

PALINGENIA FULIGINOSA, Georgi.

Ephemera fuliginosa, Georgi, Geogr.-physik. u. naturhist. Beschr. d. russischen Reichs, Th. iii. vi. p. 324 (1802).

Palingenia fuliginosa, ! Hag., Trans. Ent. Soc. London (1873), p. 392.

Adult (*dried*) ♂.—Wings deep raw-umber brown, translucent, dull. Compared with *P. longicauda*, the sinuous first axillary nervure (9^1) of the fore wing is more strongly arched towards the inner margin; and the first of the subsidiary nervures enclosed by the fork of the anal nervure (8), instead of being diffuse, imitates on a small scale with its branches the same main nervure and its branches in an appreciable manner. Prothorax above somewhat pale ochreous, the remainder of the thorax chiefly brown-ochre. Abdomen above rather darker than the wings; the pleura and venter, forceps and setæ, pale yellow-ochre. Sides and underside of thorax and the femora slightly deeper in tint than the venter, the tibiæ and tarsi tinged with ashy-grey; vertex of head brown-ochre, with the orbits of the ocelli blackened. Approximate admeasurements:—length of body 25, wing 25, setæ upwards of 55 mm.

Hab. The Caucasus.

Subgenus ANAGENESIA.

Adult.—Præbrachial nervure (6) of the fore wing forked before the middle; three conspicuous sets of longitudinal nervures proceed in pairs to the terminal margin (at 4^1, 5 & 6, and 6^1). Fore tarsus of ♂ shorter than the femur. Setæ 2, in ♂ upwards of three times as long as the body, in ♀ about half as long as it.

Nymph.—Divisions of the abdominal tracheal branchiæ, of uniform shape, unequal; each division is a narrow membranous lamina folded length-wise, fringed with short simple fibrils, to which are distributed colourless air-vessels from a dark median trunk. In a nymph from Ceylon the clypeus has a globular tubercle in the middle of its front edge; there is a triangular tubercle above the insertion of the antenna, and one in a line with the eye on each side of the prothorax. The bearding of the fore femur is restricted to a rounded patch at the base beneath, and is almost erect; that of the tibia is spreading, and clothes the sides and the front, and in the latter position a scanty series of long tactile hairs stands erect. In the hinder legs the femoral patches are insignificant, the tibia and tarsus are ciliated outside, and the tibia is shortly and densely pilose on its distal border, and towards its extremity beneath. Antennæ setaceous, shorter than the head; the first three joints longer than any of the others, which are almost nude; the second joint furnished with a dense patch of hair outside. Labrum small. Mandibles short and stout, distally pilose, and with a curved patch of long spreading hair near the base on the outside; the crown, somewhat wedge-shaped and irregularly dentate, is remote from the molar protuberance. Lacinia of the upper maxilla flattened and obliquely truncate, pungent, and crowned with a dense beard, also bearded within below the point, the last line of hair shortly and obliquely decurrent upon the outside; first joint of the palpus nude; second joint much the longer, slightly incurved towards its acute extremity, and densely pilose nearly all over. Labium and

lower maxillæ as in the typical form. Lingua acutely ovate; the paraglossæ rather narrow, connivent. Setæ about $\frac{1}{4}$ as long as the body.

Distribution. Indo-Malay region and Irkutzk.

Type. P. lata, Walker.

Etymology. ἀναγενεσία, regeneration.

Palingenia sibirica, McLach.

Palingenia sibirica,! McLach., Ann. Soc. Ent. Belg. xv. 50, pl. i. 1–1*a* (1872).

Adult ♂ (*dried*).—Fore wings pale yellowish-brown, darkening gradually towards the tip; neuration for the most part pale, but some of the veinlets in the marginal and submarginal areas are blackish. Hinder tarsi with one claw each; legs whitish. Head pale yellowish; a black spot at the base of each antenna, a subtriangular blackish spot contiguous with the oculus on each side of the vertex, the sutures of the cranium blackish, and two brownish occipital clouds. Notum blackish; the borders and median stripe of the pronotum pale. Abdomen above blackish; the segments pale at the sides, and very narrowly so at the tips; venter pale. Setæ pale, with fine short pubescence. Length of body 21 mm.

Hab. Irkutzk, 20th of May (McLach. Mus.). There is a specimen in Baron de Selys-Longchamps's collection.

Palingenia lata, Walk. Plate I. 1 *b* (wing).

Palingenia lata,! Walk., List Neuropt. Brit. Mus. iii. 550 (1853); Etn., Trans. Ent. Soc. Lond. (1871), p. 63, pl. iii. 18–18 *b* (1871). *P. ampla*, McLach., Ann. Soc. Ent. Belg. xv. 50 (1872) [nominal reference—part].

Adult (*dried*) ♂.—Wings and thorax light Vandyke-brown; the longitudinal neuration of the former, the cross veinlets in the basal half of the disk of the fore wing, and also those contained within the narrow interspaces of the nervures, distributed in pairs to the terminal margin, opaque and dark Vandyke-brown; the fork of the anal nervure (8) encloses a single longitudinal nervure. Femora nearly concolorous with the wings; the fore femur dark above, the hinder tibiæ and tarsi greyer, and transversely rugose. In dried examples the ungues of the hinder tarsi appear to be single. Abdomen faded, fuscous above. Setæ very light dull brownish yellow, pilose with uniform hair. Length of body, ♂, 22, wing 23, setæ about 70 mm.

Hab. Silhet.

Palingenia ampla, sp. nov. Plate I. 1*c* (wing).

Adult (*dried*) ♂.—Wings (as opaque objects) uniformly deep warm sepia-grey, modified in transmitted light with light sepia-brown, their neuration for the most part opaque; in the fore wing, the fork of the anal nervure (8) encloses a single longitudinal nervure. Venter very light bistre-grey modified with equally light Vandyke-grey; hinder femora nearly of the same colour beneath as the venter, but Vandyke-brown above; fore femora faded; all the tibiæ and tarsi (probably faded) extremely light Vandyke-grey, transversely rugose; the hinder ungues darker and single. Setæ light

warm sepia-brown, with opaque joinings, and pubescent, with a few hairs at the joinings longer than the others. Length of body, ♀, 17, wing 18 mm.

Hab. Sarawak.

Palingenia javanica, sp. nov. Plates I. & II. 1 *d* (forceps, ♂, legs, fore wing, and parts of setæ).

Adult (*dried*) ♂.—Wings dark subtestaceo-cervinous, with opaque neuration; the veinlets along the terminal margin of the fore wing less sparse and better defined than in the wing of *P. tenera*. Body faded above; venter and setæ subtestaceous, the genitalia luteo-testaceous; the setæ for some distance in the middle portion of their length are furnished at the joinings with a few spreading hairs, longer and stronger than the hairs of the universal pubescence. The fore legs and the hinder tibiæ and tarsi opaque whitish; hinder femora testaceo-lutescent; fore tibia on the inner side at the tip armed with a small more or less acute tubercle; intermediate legs the shortest pair, hind legs the longest, and more than half as long as the abdomen; ungues of the hinder tarsi very unequal, the lesser hardly visible; those of the fore tarsus more nearly alike, and well developed. The last two joints of each forceps-limb are together very nearly half as long as the antepenultimate joint. Length of body, ♂, 19, wing 22–23·5, setæ about 60–70 mm.

Hab. Orawang (Java occid.). Five examples in Leyden Mus. communicated to me in 1876 by Mhr. C. Ritsema. The MS. name by Van Vollenhoven attached to one of them (No. 50), being preoccupied in Ephemeridæ, is not adopted.

Palingenia tenera, sp. nov. Plate II. 1 *e* (wing and part of setæ).

Adult (*dried*) ♂.—Wings dark cinereous, with the longitudinal nervures and the coarser of the cross veinlets subpiceous or fuscous, and with the finer of these whitish or edged with whitish when viewed obliquely so as to reflect light. Body discoloured, genitalia pale testaceous, setæ almost concolorous with the wings. Legs very short in comparison with those of *P. javanica*, the posterior femur not extending to beyond the second abdominal segment; fore legs faded (whitish?), posterior femur subochraceous. Pubescence of setæ composed of uniform hairs. Length of body 17, setæ circ. 55 mm.

Hab. Ardjoëno (Java orient.). One example in the Leyden Museum. A smaller insect than *P. javanica*, having wings free from the least tint of testaceous, and with more delicate neuration.

Palingenia papuana, Etn. Plate II. 1 *f* (wing and forceps, ♂ adult).

Palingenia papuana,! Etn., Annal. Mus. Civ. di Stor. Nat. di Genova, xiv. 398, woodcut *a–f* (1879).

Adult (*dried and in spirits*).—Wings in the ♂ white with light yellowish neuration, the membrane during life somewhat creamy-white; in the ♀ the wings are spotted with black. The fork of the anal nervure of the fore wing contains a single longitudinal nervure. Setæ pubescent with uniform hair. Fore femur in the ♂ not much shorter than the fore tibia; intermediate tarsus about as long as the intermediate tibia; hinder

tarsi biunguiculate, the ungues very unequal (*l. c.* woodcut *b*, *c*). Forceps short and stout, their last two joints very short. Length of body, ♂ 36, ♀ (after oviposition) 32; wing, ♂ and ♀, 27; setæ, ♂ 50, ♀ 17 mm.

Hab. Near the island of Ellangowan, in December 1875, in insignificant numbers; and on Fly river, New Guinea, on the 2nd of July, 1876, in extreme profusion (Signor L. M. d'Albertis). Specimens in fluid are in Mus. Civ. di Stor. Nat. di Genova, and in McLach. Mus., and some remnants of a pinned ♂ example in Brit. Mus.

The 'Annali' above cited, after my diagnosis of the species, quote a passage from Signor d'Albertis's travels relating to this insect, whose purport may be thus freely summarized. On the 2nd of July, 1876, a few hours before sunset, we witnessed a strange and magnificent sight produced by an abundance of a species of Mayfly, actively pursued by the following birds:—*Calornis metallica*, *Artamus cucopygialis*, a *Gracutus*, a *Eurystomus*, and the commonest Whiteheaded Osprey, *Haliastur girrenera*. Simultaneously the insects were being preyed upon by thousands of fishes, who rushed up to seize them whenever they touched the water with their delicate wings. But so profuse was the abundance of the flies, that the ravages of all their destroyers caused no appreciable diminution in their numbers. Mile after mile, from bank to bank, the river seemed covered with them, when all at once, as if by signal, the whole of them rose up confusedly, flying aloft in a thousand different directions, producing an effect in the air like that of a heavy fall of snow; then they descended again, and the snow seemed to cover the river with a white layer. The males very largely outnumbered the females.

Subgenus ——.

? Palingenia atrostoma, Weber.

Ephemera atrostoma, Weber, Obs. Ent. 99 (1801).

Palingenia atrostoma, Pict., Hist. Nat. Névropt. ii. Ephém. 157 (1843–5); Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 550 (1853).

? *Hexagenia atrostoma*, Etn., Trans. Ent. Soc. London (1871), 65.

Wings fuscous. Body yellow; mouth black; dorsum of abdomen fuscous; setæ fuscous.

Hab. Brazil. In 1871 I ranked this species conjecturally with *Hexagenia*. At that time the genus *Palingenia* was not positively known to be represented in America; but now that a species of this group (represented by the nymph in the Museum of Comparative Zoology, Cambridge (Mass.), figured in Pl. XXV. of the present work) has been ascertained to occur in the Amazons, Weber's description of the species *atrostoma* as "Gigas in hoc genere; thorax marginatus canaliculatusque; cauda biseta, setis longissimis," taken in connexion with the colours of the wings and body, lends probability to the supposition of its being a *Palingenia*. Pictet was disposed to refer it to what is now known as *Campsurus*. The furrows of the thorax are adverse to its being considered to be a *Euthyplocia*.

Subsection B of Section 1.—Wing-neuration scanty; anal nervure (8) of the fore wing curved; axillary nervures either rudimentary or obsolete, or represented by a branch of the anal nervure (8) that meets the terminal margin; wing-membrane transparent;

recurrent membrane at the fore-wing roots often prolonged into a narrow free-pointed appendage beyond the peak of the mesonotum; hind wing traversed lengthwise by a contracted fold. Pronotum compact, transverse, arched behind. Setæ in ♀ short, smooth, and usually glabrous; in ♂ very long, and more or less pilose. Forceps—limbs inserted upon the sides of a laminar lobe extending from the distal ventral margin of the 9th segment, which lobe is probably not deflexible, but is sometimes represented in the ♀; their proximal joints the longest. Penis exposed, the lobes unarmed (excepting perhaps in *Lachlania*); but stimuli capable of extrusion are in some genera concealed in the 9th segment. Proportions of eyes and ocelli vary with the genus. Fore legs of ♂ short and slender; the tibia and tarsus often transversely rugose, the femur nearly as long as the tibia, the ungues usually alike, the tarsus shorter than the femur; hind legs usually the longest pair, the ungues subequal, broad, sometimes dissimilar, commonly flaccid.

Nymph (*Oligoneuria* only).—Labium flat; abdominal tracheal branchiæ inserted in the axils of notches in the posterior margins of the segments close to the lateral angles, which angles are prolonged backwards. Fore legs strong, the femur and tibia densely bearded beneath or behind with long hair, the tibia and tarsus slender in comparison with the femur. The terminal margins of the fore wings are united by membrane forming a hood. [I believe these characteristics are common to all the nymphs of this alliance, judging from the structure of the adult flies.]

(*a*.) Wing-membrane dull or satin-like; fore wing with the anal nervure (8) forked, and with a free epinotal appendage; 3 caudal setæ.

OLIGONEURIA, Pict. 1845.

Illustrations. Adult (details) Pl. III. 2 *a–b*; (whole figures,) see citations of Costa, Pictet, and Hagen (1855), under *O. rhenana* and *O. anomala*. *Nymph*, Pl. XXVI.; see also citations of Joly and Vayssière (*O. garumnica*), under *O. rhenana*.

Adult.—Fore wing with 5 longitudinal nervures, beside the costa and subcosta (this last concealed), and with several series of cross veinlets in the fore part of the wing. Setæ subequal in length to one another; in ♂ about $1\frac{1}{2}$ as long as the body, and pilose at the joinings; in ♀ at most $\frac{2}{3}$, and at least $\frac{1}{4}$, as long as it. Eyes in ♂ somewhat reniform, and approximated to each other above; in ♀ oval and remote; anterior ocellus not much smaller than the others. Spinose prolongations of the posterior lateral angles of the abdominal segments slender, those of the 8th and 9th segments the strongest. Thoracic spiracles open in the dried insect; aperture of the anterior triangular, that of the posterior ovate, narrowed below.

Nymph (*O. rhenana*).—Six dorsal pairs of tracheal branchiæ, borne upon segments 2–7, and a ventral pair on segment 1, all alike composed of a small, thick, coriaceous, subrotund lamina, with a tuft of fibrils at its point of attachment. Divisions of the labium intimately coherent: 1st maxillæ furnished with a tuft of fibrillose tracheal branchiæ at the outer base of the palpus.—In the nymph of *O. rhenana*, the bearding of the fore leg is restricted to well-defined patches on the inner (or hinder) side of the tibia and femur, the rest of the legs being almost quite glabrous; the intermediate

tarsus is minutely spinulose beneath; the hind tibia is similarly spinulose behind distally; the tibia and tarsi are all slender, and the femora distally somewhat enlarged; the tracheal laminæ are spinulose also. Head semielliptical, arched above from side to side, and shelving from behind, so as to be wedge-like in vertical section, the underside being flattened. Antennæ glabrous, setaceous, the first two joints the largest. Labrum slightly retuse in front, and diffusely pilose along its anterior border. Mandibles distally enlarged, the molar tuberosity continuous with the crown, compact, and relatively large; the three fangs slender and small, the innermost appendiculated. Lacinia of 1st maxillæ small, ovate lanceolate, pungent, densely bearded inside, pubescent outside; the palpus very large and stout, the first joint minute, pubescent outside; the second joint relatively enormous, finger-like, curved, tapering distally, within and without at the tip densely hairy above, more sparsely pubescent beneath; the stipes closely associated with the fan-like branchial tuft of fibrils, which passes backwards above and beyond the hinder border of the labium, and underlies the prosternum. Laciniæ of the 2nd maxillæ (if developed at all) adherent to the labium in the form of two elevated folds of membrane; palpus strong and finger-like, the first joint short, pilose; second joint pubescent, long, and stout. Lingua somewhat broadly cordate; the paraglossæ well developed and somewhat rounded. Outer setæ less than half as long as the body.

Distribution. Europe, middle and south, and Brazil.

Type. O. anomala, Pict.

Etymology. ὀλίγος and νευρίον, from the paucity of cross veinlets in the wings.

The following differences between the adult European and Brazilian species may here be noted, because they may be accompanied by unconformity in the nymphs, and be of more than specific value. *O. anomala*, ♀, has the setæ equal to each other in length, and sparingly pilose. The ♂ has the fore tibia relatively shorter in proportion to the femur than *O. rhenana*, and the proximal joint in all the tarsi longer than the second joint. In *O. rhenana*, ♀, the intermediate seta is slightly shorter than the outer setæ, and all are glabrous. The ♂ fore tibia is about $1\frac{1}{2}$ (instead of only $1\frac{1}{5}$) as long as the femur, and the proximal joint in all the tarsi is shorter than the second joint.

Oligoneuria anomala, Pict. Plate III. 2 *b* (♂, wings, legs, and forceps, ♀, legs).

Oligoneuria [type] *anomala*, Pict., Hist. Nat. Névropt. ii. Ephém. 290, pl. xlvii. (1843–5); Walk., List Neuropt. in Brit. Mus. part iii. 585 (1853); Hag., Stet. ent. Zeit. xvi. 269, pl. i. (1855); Etn., Ent. Mo. Mag. v. 83 (1868); id., Trans. Ent. Soc. London (1871), 55.

Adult (dried) ♂.—Wings transparent light sepia-grey, with opaque light pitch-brown longitudinal neuration, the membrane giving a dull light purple-grey reflection. Thorax pitch-brown. Abdomen in segments 8–10 and in the distal halves of segments 2–7 pitch-brown, the anterior halves of these being pellucid white. Setæ warm sepia-grey, with alternately wide and narrow light pitch-brown annulations at the joinings. Legs subpiceous, the hinder tarsi with their terminal joint white, and ungues pieceous.

♀ (after Hagen). Body fuscous or brown. Wings light grey, the fore wings with about six cross veinlets [in the space behind nervure no. 3]. Length of body, ♂, about 7, ♀ (Hagen) 13; wing, ♂ 8, ♀ 15; setæ, ♀ 8 mm.

Hab. Brazil (*Pict.*), Rio Mauhes, "at light," 5th May, 1874, and Rio Jutahi, "at light," 1st to 5th February, 1875 (*Trail*); both sexes in M°Lach. Mus. The cross veinlets in the marginal area of the fore wing are not easily discovered in a dried wing; and those in the space behind the nervure numbered 3 in my figure vary within two or three of the number (six) quoted. The dimensions of the ♀ in M°Lach. Mus. are identical with those stated by Hagen.

OLIGONEURIA RHENANA, Pict. Plate III. 2 *a* (wings, ♂ and ♀, head, ♂, 3 views, legs, ♂, and forceps, tip of a forceps-limb and penis). *Nymph*, Pl. XXVI. (whole figure and details).

[*Nameless*], Costa, Fn. di Aspromonte, pl. i. 2.

Oligoneuria ‡ *anomala* (part), Pict., Nat. Hist. Névropt. ii. Ephém. pl. xlvi. (143–5); Kirschb., Jahresb. Vereins f. Naturk. Nassau, Heft ix. 14–5 (1853). *O. rhenana*, Imh., Bericht über Verhandl. d. naturf. Gesellsch. Basel. x. 177–180 (1852); Hag., Stet. ent. Zeit. xvi. 267, pl. i. (1855); Brau., Neur. Aust. 25. (1857); Rogenhofer, Verh. zool.-bot. Ver. Wien, vii. 130 (1857); Mül., Ent. Mo. Mag. i. 262 (1865), and ii. 182 (1866); Etn., *op. cit.* v. 83 (1868), and Trans. Ent. Soc. London (1871), p. 55, pls. i. 2, and iii. 7–7 *a*; Hag., *op. cit.* (1873), p. 390–1; Meyer-Dür, Bull. Soc. Ent. Suisse, iv. 307 (1874); translation of Imhoff, 1852, by Joly, Bull. Soc. d'Etud. Sc. Angers, Ann. 4–5me, pp. 37–40 (1876). *O. pallida* (*O. rhenana*, var.?), ! Hag., Stet. ent. Zeit. xvi. 268, pl. i. (1855); ! Etn., Trans. Ent. Soc. London (1871), p. 56. *Nymph.*—*O. Garumnica*, ! Joly, Zoologist (1873, Aug.) 36555–7, figs. A, B; *idem*, Proc. Ent. Soc. London (1873), p. xx. figs. A, B; ditto, Bull. Soc. d'Etud. &c. Angers, pp. 37–9 & 46, figs. A, B (1876); ditto, Rev. d. Sc. Nat. Montpellier, v. 9 (1876, Dec.); ditto, Bull. Soc. d'Et. des Sc. Nat. Nimes, Ann. 6e, no. 4 (separate pgs. 8), figs. A, B [inferior to the earlier figures] (1878, April); *idem*, Compt. Rend. Soc. d'Et. des Sc. Nat. Nimes, 1878, pp. 64–9; Vayssière !, Ann. Sc. Nat. (6) Zool. xiii. 54, figs. 52, 58–65 [whole figure and details] (1882). *O. rhenana*, ! Mül., Mitth. schweiz. ent. Gesellsch. v. 384–6 (1878).

Subimago.—Body much browner than that of the adult fly.

Imago, living, ♂.—Head and thorax brown-ochreous, eyes black. Abdomen white, the segments pellucid in their basal halves and opaque behind, their distal dorsal borders narrowly edged with greyish; in the dried insect the opaque portions of the segments become lutescent or ochreous; in the 9th ventral segment (prior to their extrusion) are visible through the integument the light yellowish chitinous mandibuliform appendages to the penis. Setæ and forceps white. Fore legs from the coxa to the base of the femur whitish, and from thence sepia-brown; hinder legs white, with yellowish white femora and dark ungues: when dried, the fore legs and hinder femora become light yellowish brown. Wings greyish with opaque neuration, the stronger nervures sepia-grey.

♀. Abdomen previous to the extrusion of the eggs bistre-brown, and opaque when dried, afterwards very light brownish-ochreous; eggs lutescent. Thorax brown-ochreous, head rather browner in front, legs when dried light bistre-brown or brown-ochreous. Length of body, ♂ 9–13, ♀ 12–15; wing, ♂ 11–14, ♀ 14–16; setæ, ♂ im. 12–13, subim. (slough) 4; ♀ im. 3–4, subim. 2·5–3 mm.

Hab. The Rhine, Cologne to Basel; the mill-stream at Versoix, Geneva; France, Brive (Haute Loire), Toulouse (Haute Garonne), and Tarascon (Ariège); Portugal,

Ponte de Morcellos (Beira Baixa); Italy, Turin, and Breno (Val Camonica, Breseia to the Neapolitan territory (locality —? *fide* Costa); Hungary (var.? *pallida*, Hag.); Galicia, Stry (*fide* F. Brauer). The terminal small joints of the forceps-limbs appear to be variable in number, and the specimens from France, Geneva, and Italy are much lighter in colour than some of older date from the Rhine with which I have compared them. This difference in colour may be due to my specimens having been killed with fumes of prussic acid (Potassium-cyanide bottle); and the variation in number of the forceps-joints is probably of common occurrence. In the absence of examples in spirits, I failed to arrive at any decision as to the rank of *O. pallida*, Hag., as a var. of *O. rhenana* or a separate species.

ELASSONEURIA, Etn. 1881.

Illustrations. *Adult* (details) Pl. III. 3; also Trans. Ent. Soc. London (1871), p. iii. 9, 9 *a*.

Adult ♀.—Fore wing with only three longitudinal nervures, besides the costa and concealed subcosta, of which the hinder two are forked; cross veinlets more restricted in their range than those in the fore wing of *Oligoneuria*. Pronotum transverse, prolonged on each side into a deflected oblong lobe. Aperture of the anterior thoracic spiracle triangular, its upper edge straight, that of the posterior spiracle oval. Setæ nearly coequal in length, about $\frac{1}{3}$ as long as the body, the intermediate seta rather slender, all of them glabrous excepting towards their tips, where for a short distance they are sparingly pilose. Eyes oval and remote; anterior ocellus not much smaller than the others. In other points very like *Oligoneuria*.

Distribution. Natal.

Type. *E. Trimeniana* (in *Oligoneuria*), M'Lach.

Etymology. ἐλάσσων and νευρίον, from the greater paucity of the neuration in comparison with that of *Oligoneuria*.

Elassoneuria Trimeniana, M'Lach. Plate III. 3 (wings, ♀).

Oligoneuria Trimeniana,! M'Lach., Ent. Mo. Mag. iv. 177–8 (1868); ! Etn., *op. cit.* v. 83 (1868); *id.*, Trans. Ent. Soc. London (1871), 56, pl. iii. 9–9 *a* [penult. ventr. process ♀]; Joly, Sur une Nouv. Esp. d. Gen. d'Ephém. Oligoneuria &c. Nimes (1877), 6 figs. 8vo. [transl. of M'Lachl. 1868].

Elassoneuria [type] *Trimeniana*,! Etn., Ent. Mo. Mag. xvii. 191 (1881).

Adult (*dried*) ♀.—Head and thorax brown-ochreous above, lighter beneath. Abdomen discoloured; eggs formerly green, now brown-ochreous. Setæ opaque-whitish. Wings transparent, very slightly tinted with light smoke-grey, giving a faint very light cobalt or ultra ash-blue glance, soft as the gloss of satin; neuration opaque, light smoky-grey. Length of body, ♀, 12, wing 22·5, setæ 4 mm.

Hab. Mapumulo Mission Station, Umvoti District, Natal. Captured "at light" on 3rd of March, 1867 (M'Lach. Mus.).

(*b.*) Wing-membrane "shot" with blue or purple; the free epinotal appendage of the membrane decurrent from the wing-roots is easily broken off, but may be regarded as probably absent in *Lachlania* and *Homœoneuria*.

SPANIOPHLEBIA, Etn. 1881.

Illustrations. *Adult* (details), Pl. III. 4.

Adult.—Anal nervure of the fore wing forked; the membrane decurrent from the wing-roots terminated by a free epinotal appendage; cross veinlets comparatively numerous in the anterior portion of the wing; the nervure next in advance to the anal (8) deeply forked. Aperture of the anterior thoracic spiracle fissure-like and gaping in front (in the dried insect), closed by a single, large, arched, dorsal valve rounded at the edge; the anterior and lower margins of the orifice meeting in front at an angle, without valves; that of the posterior spiracle is large, roundly subtriangular, and valveless, with a small salient lobule projecting from its front edge. Setæ 2. Hinder lateral angles of the intermediate abdominal segments shortly prolonged into slender projections that are easily broken off. Fore tibia of ♂ about as long as the femur; the proximal joint in every tarsus longer than the second joint. Eyes of ♂ hemispherical, relatively small, remote from each other above; the foremost ocellus rather smaller than the others.

Distribution. Tropical South America.

Type. S. Trailiæ.

Etymology, σπάνιος and φλέβιον, from the scanty cross neuration.

Differences in the neuration of the fore wings of the two species provisionally placed in this genus are specified in the descriptions. There are other incongruities between them. The ♂ Brazilian species has pilose setæ about as long as the body; those of the Ecuador ♂ are pubescent, and about $2\frac{1}{2}$ as long as the body. The latter certainly possesses the epinotal appendages mentioned above; but these are not so surely present in the Brazilian.

SPANIOPHLEBIA TRAILIÆ, Etn. Plate III. 4 (wings, legs, and forceps, ♂).

Spaniophlebia [type] *Trailiæ*, ! Etn., Ent. Mo. Mag. xvii. 191 (1881).

Imago (dried and in alcohol), ♂.—Body pitch-brown, the thorax darker than the abdomen; the latter with the tenth dorsal segment, and the lateral borders of the other segments above the spiracular margin as dark as the thorax, but with the joinings of the segments pale. Setæ, in the dried specimen pitch-black, with testaceous pilosity; but in the specimen in fluid both are testaceous; forceps whitish. Legs pitch-black, the ungues of the hinder tarsi whitish: in alcohol the legs from the coxa to the knee are light pitch-brown, and the rest of the tibia with the tarsus dirty white. Wings transparent, tinted throughout, very faintly indeed, with smoky-grey, so as scarcely to diminish their limpidity, and giving a light blue-purple or (in other positions) a mauve reflection; neuration piceous, the quasi-subcosta (no. 3) of the fore wing, distally, and the cross veinlets that join it, margined for some distance with intense warm sepia-brown, which colouring occupies the pterostigmatic space, and imparts a slight tint to the rest of the marginal area. The nervure (pobrachial ?) in front of the anal (8) of the fore wing, is forked before the middle, at about the same distance from the wing-roots as the anal nervure, and is met nearer the base of the wing by one of two simple nervures interposed

between it and the quasi-subcosta (3). This simple nervure (præbrachial?) forms the posterior limit of the region provided with cross veinlets; of these there are about 25 in the marginal area, from 2 to 5 in the next area, and one or two in the area next to that. Length of body 9, wing 10, setæ 8 mm.

Hab. São Paulo, Rio Solimões, October 13, 14, and November 26th, 1874 (*Trail*, McLach. Mus.), "at light."

SPANIOPHLEBIA PALLIPES, sp. nov.

Adult (*dried*), ♂.—Pronotum, sides and underside of the thorax, the hinder border of the mesonotum, and the metanotum, light Vandyke-brown; the mesonotum in advance of the peak, darker or dull black. Abdomen discoloured, lighter beneath than above; the dorsum nearly concolorous with the metanotum. Setæ white, pubescent throughout. Fore femur in opaque view very light dull brownish-yellow, changing in transmitted light to light yellowish-amber; the tibia in opaque view nearly of the same colour as the femur, but light brown at the tip; the short joints, the ungues and the tip of the terminal joint of the tarsus light brown, the rest of the terminal joint whitish brown. Hinder legs very similar but a little lighter. Wings transparent, tinted, very faintly indeed, with extremely light Vandyke- or sepia-grey, changing in some positions to a like shade of Roman sepia-grey, and "shot" with a rather dull intense blue; their neuration in a large extent light pitch-brown, growing paler towards the wing-roots, changing in some lights to light Vandyke- or warm sepia-brown. The nervure in front of the anal (8) of the fore wing is joined by a weak and flexuous branch nearly in the middle of the wing, at a point further from the wing-roots than the fork of the anal nervure, and shortly before the great cross vein, is joined also by the longer of the two nervures interposed between it and the radius (3); the shorter of these interposed nervures meets the radius a little beyond the middle; the subcosta is visible at the bottom of a deep fold of the membrane when the wing is viewed edgeways from in front, but is concealed by the radius when the wing is viewed from above; the anal nervure bounds posteriorly the portion of the wing traversed by cross veinlets; the number of these in the marginal and submarginal areas (if any exist there) cannot be ascertained; but in the area between the radius (3) and the shorter of the interposed nervures are 6–8, which are thickened towards their junction with the radius; in the next area are 5 or 6 cross veinlets; within the fork of the next nervure 2 or 3; and between this nervure and the anal, from 2 to 4 cross veinlets. Length of body, ♂, about 11 (not allowing for shrinkage); wing 16–17; setæ 40 (or more) mm.

Hab. Ecuador (McLach. Mus.).

LACHLANIA, Hag. 1868.

Illustrations. *Adult* (details), Pl. III. 5 (whole figures), see citations of Hagen and Packard under *L. abnormis*.

Adult.—Anal nervure of the fore wing forked; no epinotal free appendage to the membrane decurrent from the wing-roots; cross veinlets, as a rule (with rare individual

exceptions), uniserial in a transverse row extending to the nervure next in advance of the anal; that nervure is forked shortly, or beyond the middle. Aperture of the anterior thoracic spiracle triangular, with a salient angular valve above, its lower lip straight; that of the posterior spiracle small and round. Setæ 2, in ♂ (pilose?) about $2\frac{1}{2}$ as long as the body, in ♀ glabrous, about $\frac{1}{2}$ as long as it. Proportion of ♂ legs not observed. Eyes of ♀ large for the sex; the anterior ocellus rather smaller than the others. Slender projections, easily lost, are prolonged shortly from the hinder lateral angles of the intermediate abdominal segments; 9th ventral segment of ♀ hardly produced behind into a lobe, but cleft in the middle.

Distribution. Cuba and Central America.

Type. L. abnormis, Hag.

Etymology. R. M'Lachlan, the British neuropterist.

LACHLANIA ABNORMIS, Hag. Plate III. 5 (wings, ♀).

Lachlania abnormis! Hag., Proc. Boston Soc. Nat. Hist. (1868), 372–4, fig.; Packard, Guide to Study of Ins. ed. i. 596, fig. 578 [after Hag.] (1870); Etn., Trans. Ent. Soc. London (1871), 54, pl. i. 1 [after Hag.].

Adult (*dried*), ♀.—Body above warm sepia-brown, beneath lighter; head, prothorax, femora, and the spiracular border of the abdominal segment, piceous; tibiæ and tarsi lighter, especially the ungues; setæ whitish. Wings transparent sepia-grey, with an intense blue-purple reflection, and light (Vandyke) brown neuration; the finer of the cross veinlets much lighter than the others. In the fore wing, a single series of cross veinlets extends in a slight curve from the (functional) subcosta (no. 3) to the anterior branch of the forked longitudinal nervure (pobrachial?) next in advance of the anal (8); the series is sometimes continuous, and sometimes broken by a slight displacement of the second or third veinlet; the posterior branch of the pobrachial is weak, and very similar in colour and calibre to hindermost cross veinlet. Length of body, ♀, 6–7; wing 9–10; setæ 5 mm.

Hab. Cuba (Hag. & M'Lach. Mus.).

LACHLANIA LUCIDA, sp. nov. Plate III. 5 (forceps).

Imago (*dried*), ♂.—Thorax picco-fuscous; abdomen fuscous, broadly annulated with white near the joinings; forceps and setæ whitish. Fore legs and posterior femora fuscescent, tarsi and posterior tibiæ white, with dark ungues. Wing-neuration subfuscescent.

♀. Thorax luteo-piceous; abdomen darker than in the ♂; in other details very like the ♂. Wings tinted as in *L. abnormis*, the membrane reflecting bright (medium smalt) blue. Length of body 11–12; wing, ♂ 12, ♀ 14; setæ, ♂ circ. 30, ♀ 7 mm.

Hab. Guatemala (♂ ♀, Paris Mus. Jardin des Plantes); Central America (2 ♀, M'Lach. Mus.).

HOMŒONEURIA, Etn. 1881.

Illustrations. Adult (detail). Pl. III. 6.

Adult.—All of the nervures of the fore wing simple; membrane decurrent from the wing-roots, apparently destitute of any free epinotal appendage; no cross veinlets.

Aperture of the anterior thoracic spiracle oblong, with a salient rounded drooping valve at its upper border; that of the posterior spiracle round. Setæ 3, in ♀ subequal, glabrous, about ¼ as long as the body. Hinder lateral angles of the intermediate abdominal segments acute, but seemingly not prolonged into projections; 9th ventral segment not prolonged into a lobe behind, nor cleft, but entire.

Distribution. Central America.

Type. H. Salviniæ.

Etymology, ὅμοιος and νευρίον, from the mutual likeness of the wing-nervures.

HOMŒONEURIA SALVINIÆ, Etn. Pl. III. 6 (wings, ♀).

Homœoneuria [type] *Salviniæ*! Etn., Ent. Mo. Mag. xvii. 192 (1881).

Imago (dried), ♀.—Head and thorax pitch-black above; abdomen dark warm sepia-brown above, with the joinings either transparently whitish or opaque sepia-brown, according as this region is distended or not; belly warm sepia-grey, with the hindermost 3 or 4 segments warm sepia-brown; setæ pitch-black. Legs concolorous with the venter; the fore legs darker than the hinder. Wings transparent, faintly smoky, with a glowing purplish French ultra-blue reflection, changing (in a very oblique front view) to very light purple-madder bronze; neuration opaque, coloured and bordered narrowly with very light bistre-brown. Length of body, ♀, 8–11; wing 8–12; setæ 2·5–3·5 mm.

Hab. Guatemala; Dueñas, 4950 ft., and Accytuno, 5100 ft. alt. (Salvin, in M'Lach. Mus.). The specimens were secured early in the morning while floating dead upon the surface of the stream, when the flash of the wings was very conspicuous. In some examples, the thinner portions of the integument in the hinder parts of the notum are whitish.

Section 2 of the Genus, Type of *Polymitarcys*. *Adult.*—Subcosta of the fore wing displayed (except in dried *Campsurus*, ♀). Posterior margin of 9th ventral segment in ♀ not extended into a lobe. Pronotum tumid; its hinder border straight (excepting perhaps in *Jolia*, ♂, it may be sinuous behind).

Nymph fossorial or predatory; in those that are known, the median lobe of the tongue is obtuse.

EUTHYPLOCIA, Etn. 1871.

Illustrations. Adult (details), Pl. IV. *Nymph* (whole figure and details), Pl. XXIX., see also Pict., Hist. Nat. Névropt. ii. Ephém. Pl. XV. 2–4 [with circumspection].

Adult.—Discal cellules of the fore wing large, and in the vicinage of the terminal and inner margins transversely elongated, especially those posterior to the sinuous anal nervure, which are themselves sinuous. ♂, fore leg about as long as the head and body together: the tarsus longer than the femur, which is about ⅔ as long as the tibia. Tarsal ungues equal and nearly alike. Aperture of the anterior thoracic spiracle elongate, or oval, in the dried insect, with an arched upper valve; that of the posterior spiracle narrow, elongate and gaping. Setæ 3, subequal, about 3⅔ as long as the body in the ♂; in ♀ glabrous, but in ♂ sparsely pubescent beyond the middle. ♂, eyes of moderate proportions, mutually remote; anterior ocellus the smallest. Forceps-limbs inserted at

the sides of a short deflexible lobe prolonged from the hind margin of the ninth segment; their proximal joint very short, the second much the longest. Penis extruded and rather similar to that of *Campsurus 4-dentatus* (Pl. V. 8 *e*), without apparent stimuli. No projections at the hinder lateral angles of the abdominal segment.

Nymph.—Raptorial, furtive; mandibles tusked; fore tibia spurred; 6 pairs of abdominal tracheal branchiæ, inserted at the sides of segments 2–7, a little in front of the hinder angles, and arched upwards over the back, each composed of a pair of narrow uniform and subequal lanceolate membranous laminæ, folded lengthwise, and fringed with simple fibrils. Setæ rather shorter than the body, pilose to beyond the middle, and then tail-pointed. Palpi of both maxillæ 3-jointed.—Head relatively small, narrower than the thorax: pronotum subquadrate, the lateral borders narrowly dilated; terminal margins of the fore wings free; body slender. Antennæ setaceous, longer than the head. Labrum emarginate, pubescent. Mandibles prolonged into a tusk on the outer side, about twice as long as the head, densely hirsute outside and above with slightly spreading hair, and half encircled at its junction with the crown of the mandible by an interrupted verticil of widely spreading hair; the fangs are rather distant from the molar protuberance, and are set almost at right angles with the tusk, which is curved gently and regularly inwards, and tapers to a slightly oblique point; stipes very short. First maxillæ weak, the lacinia small, pubescent externally, ciliated internally, crowned with a dense tuft of short hair and terminated by a few (3 or 4) slender spines; palpus upwards of four times as long as the lacinia, rather slender, 3-jointed (exclusive of the pedicel); the first joint pubescent, the others pilose; the third joint nearly as long as the other two together. Second maxillæ almost in the form of quadrants, densely pubescent; palpus 3-jointed, geniculated at the penultimate joining, and pilose outside; the distal moiety clavate and truncate, the terminal disk hispid; the proximal joint pubescent within. Labium small, the lobes narrow and acute. Tongue perhaps distorted; medium lobe obeordate; paraglossæ moderate in size and rounded. Legs pilose above and below, the tibiæ obliquely truncate, the fore tibia spurred with a long, slender, but strong apical spine; the fore tarsus very long. (Figured and described from a dried slough in the Mus. Roy. de Bruxelles, measuring,—body (exclusive of mandibles) 30; setæ 19 mm.)

Distribution. Tropical America.

Type. E. Hecuba (in *Palingenia*), Hagen.

Etymology, εὐθυπλοκία, from the evenness of the cross veinlets.

EUTHYPLOCIA HECUBA, Hag. Plate IV. 7 *a* (wings ♀).

Palingenia Hecuba! Hag., Smithson. Miscell. Coll. (1861), Synop. Neuropt. N. Am. 40.

Euthyplocia [type] *Hecuba*! Etn., Trans. Ent. Soc. London (1871), 67; Hag. & Etn., *op. cit.* (1873), 392.

Imago (*dried*), ♀.—Head blackish fuscous, antennæ pale at the tip; prothorax glossy, fuscous; the rest of the thorax with the coxæ and trochanters luteous, the femora &c. deficient. Abdomen above blackish fuscous, luteous beneath, the setæ whitish sepia-grey, with lighter joinings. Wings dull, transparent, tinted faintly with very light warm sepia-grey ("grayish-rosy," Hag.), but rather darker along the anterior margin of

the fore wing, from the costa to the radius; neuration opaque ("gray," Hag.), light warm sepia-brown. Length of body, ♀ 20–22; wing, 35–38 mm.

Hab. Vera Cruz (Sallé in De Selys-Longchamps Mus.), Veragua (M'Lach. Mus.).

Euthyplocia anceps, sp. nov. Plate IV. 7 *c* (wings, legs, forceps from above).

Imago (*dried*), ♂.—Head and prothorax above light pitch-brown, the remainder of the notum light testaceous or pale lutescent. Dorsum dark purplish grey; venter whitish ochreous: setæ, near their insertion, tinged faintly with light purplish grey and then becoming transparent white; forceps white. Fore leg (as an opaque object) with the femur pitch-black as well as the tibia, the tarsus greyish white; in transmitted light the tibia is purple-grey, the tarsus purplish white. Hinder legs whitish yellow at the knee, light pitch-brown or fuscous. Wings transparent, in the disk slightly smoky; the fore wing tinted more distinctly with purplish- or light Roman sepia-grey in the marginal and submarginal areas, especially towards the base: neuration in great measure Roman sepia- or pitch-brown, becoming lighter and translucent in its more attenuated portions. Length of body, ♂, about 12; wing 13; setæ about 26 mm.

Hab. Rio Mauhes, Brazil (Trail, in M'Lach. Mus.).

CAMPSURUS, Etn. 1868.

Illustrations. Adult, Pl. V. 8 *a*–8 *f* (details); (whole figures) see citations of Percheron and Pictet under *C. albicans* & *dorsalis*.

Adult.—Discal cellules of the fore wing large, nearly as wide as long; the intercalated nervures, constituting branches of the cubital (5), præbrachial (6), and often of the anal (8) nervures, are convergent mutually into fascicles towards the base of the fore wing; the anal nervure is somewhat sinuous, and its course from the wing-roots is at first close alongside of the first anal nervure. Fore leg of ♂ shorter than the head and body together; the tarsus longer than the femur, which is about $\frac{1}{5}$ as long as the tibia; the ungues unequal, dissimilar, ligulate and flaccid, are unusually long. Aperture of the anterior thoracic spiracle patulous, subtriangular, with the angles obtusely rounded, and with the anterior border roundly salient; that of the posterior spiracle very large, exceeding the anterior in its dimensions, widely patulous, ovate, narrowed below. Setæ two; in ♂ about $3\frac{1}{2}$ as long as the body, divaricate in dried examples, and glabrous with the exception of a very few scattered hairs near the tips; in ♀ about as long as the body, smooth, and glabrous. ♂, eyes small, oval, mutually remote; foremost ocellus much smaller than the others. Forceps-limbs inserted each upon a separate basis, above and distinct from the posterior ventral margin of the 9th segment, and not upon a deflexible lobe prolonged from the margin; unless these bases be taken to represent proximal joints, the limbs are jointless. Penis extruded, commonly decurved, sometimes provided with well-developed stimuli. No projections usually at the hinder lateral angles of the abdominal segments.

Nymph unknown.

Distribution. Texas to Brazil.

Type. C. latipennis (in *Palingenia*), Walker.

Etymology, κάμπτω and οὐρά, from the divarication of the ♂ setæ, after death.

Campsurus latipennis, Walk. Plate V. 8 *c* (wings & forceps).

Palingenia latipennis! Walk., List of Neuropt. Inst. in Brit. Mus. part iii. 554 [excl. var.] (1853).
Campsurus [type] *latipennis*! Etn., Ent. Mo. Mag. v. 83 (1868); *id.*, Trans. Ent. Soc. London (1871), 57, pls. i. 4, & iii. 10, 10 *a* [details].

Imago (*dried*), ♂.—Thorax fuseo-luteous (eaten out by *Psocidæ*); abdomen above very light umber-grey, more distinctly so in segments 4–10 than in the others, with the joinings of the segments and the line of the dorsal vessel darker; venter testaceous; setæ pellucid white. Fore legs sepia-brown, with white ungues. In the fore wing the costa, subcosta, and radius, from the wing-roots to a little beyond the middle, are warm sepia-grey; the adjacent part of the marginal area is tinged with the same colour, or fuscescent.

Subimago.—Body very light brown-ochreous, with the setæ white or yellowish white.

♀. Pronotum bistre-grey; mesonotum brown-ochreous. Abdomen discoloured (largely denuded by *Psocidæ*) very light brown-ochreous beneath; dorsum carinated lengthwise and perhaps bistre-grey in segments 2–9. About nineteen fine, simple, almost straight cross veinlets in the marginal area of the fore wing. Length of body, ♂ ♀, 7; wings 8: setæ, ♂ im. 22, subim. 15 mm.

Hab. Pará; Toncantine (Wallace in Brit. Mus.); Santarem (Bates in M'Lach. Mus.).

Campsurus albifilum. Walk. Plate V. 8 *a* (adult ♂, head, wing, foreeps, fore leg: subim. ♂, fore leg).

Palingenia albifilum! Walk., List of Neuropt. Inst. in Brit. Mus. part iii. 554 [excl. var.] (1853).
Campsurus albifilum! Etn., Trans. Ent. Soc. London (1871), 57, pl. iii. 11 [details].

Imago (*dried*), ♂.—Pronotum very nearly light bistre-brown; mesonotum in the type discoloured by gum. Abdomen beneath light Roman-ochraceous; dorsum lighter, marked in segments 1–6 with light grey, but in segments 7–10 with light bistre-brown; the markings are:—in segment 1 a spot on each side; in segments 2 & 3 a streak from the base on each side of the middle curved outwards near the hind margin; in segments 4–7 two marks, one on each side of the middle line resembling square vincula] [placed back to back, whose extremities in the hinder segments tend to be conjoined by a narrow band of the same colour; in segments 8 & 9 a large oblong blotch on each side of the pale median dorsal line: segment 10 is light brown-ochreous with a small spot on each side. Setæ white, faintly tinged at the base with pale ochreous. Forceps and penis pale yellowish. Coxæ testaceous; fore femur and tibia deep sepia-brown. the tarsus and ungues light sepia-grey. Costa, subcosta, and radius of the fore wing light brown-ochreous at the wing-roots, and then light sepia-grey. Length of body, ♂, 12; wing 13: setæ 40 mm.

Hab. Pará (Brit. Mus.).

Campsurus albicans, Perch.

Ephemera albicans, Perch., in Guér. & Perch. Gen. d. Ins. &c. livr. vi. pl. iv. 1 (1838).
Palingenia albicans, Burm., Handb. d. Ent. Bd. ii. Abth. ii. 803 (1839); Pict., Hist. Nat. Névropt. ii.

Ephém. 149, pl. xiii. 1–3 (1843–5); Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 548 [excl. exemplar] (1853).

Campsurus albicans, Etn., Trans. Ent. Soc. London (1871), 58.

Imago (*dried*), ♂.—Prothorax yellowish, violet-grey at the sides of the notum; meso- and metathorax brown-ochreous. Abdomen pale yellowish or brown ochreous towards its hinder extremity. Legs whitish, the fore femur and tibia violet-grey. Wings whitish, tinged towards the base with violet-grey, the stronger nervures of this same colour. Length of body 10, exp. of wings 30 mm.

Hab. Brazil (*Perch.*). The description is probably insufficient in the absence of definite information of the precise locality where the type was captured. The details figured by Pictet appear to have been drawn from the dried insect, and to be misrepresented; Percheron's illustrations may have been delineated from an example in spirits. The ♀, doubtfully referred to this species by Walker (Brazil, J. P. G. Smith, in Brit. Mus.), seems rather too small to be identical with it, but may possibly be *C. curtus*, ♀. It is well, however, not to attach much weight to mere possibilities in matters of this nature.

Campsurus cuspidatus, Etn. Plate V. 8 d (forceps).

Campsurus cuspidatus, ! Etn., Trans. Ent. Soc. London (1871), 58, pl. iii. 12 [details].

Imago (*dried*), ♂.—Pronotum mouse-grey, tinged slightly with greenish. Abdomen smoky-white above, yellowish-white beneath. Wings transparent, whitish throughout. Length of body 10·5, wing 11 mm.

Hab. Guatemala (De Selys-Longchamps Mus.). This species is easily recognizable by the cuspidate outline of the subgenital plate.

Campsurus quadridentatus, Etn. Plate V. 8 c (forceps).

Campsurus quadridentatus, ! Etn., Trans. Ent. Soc. London (1871), 58, pl. iii. 13 [details].

Imago (*dried*), ♂.—Thorax and legs pale testaceous. Abdomen light yellow-ochreous, shaded with black-grey, especially posteriorly; the foremost six segments traversed lengthwise by a median black line. Wings dull translucent whitish; subcosta and radius of the fore wing black-grey or sepia-grey. Length of body 12, wing 13 mm.

Hab. Santarem, Brazil, June (Bates, in Dale Mus.). The subgenital plate of the ♂ is angularly excised behind on both sides of a large deep central subcircular sinus. The name has reference to the tooth-like projections adjacent to the excisions.

Campsurus curtus, Hag. MS. Plate V. 8 f.

Palingenia ‡ *albifilum*, var. ! Walk., List of Neuropt. Ins. Brit. Mus. part iii. 554 (1853).—*P. curta*, Hag. MS. (1861).

Campsurus [B] *curtus*, ! Etn., Ent. Mo. Mag. v. 84 (1868).

Asthenopus [type] *curtus*, ! Etn., Trans. Ent. Soc. London (1871), 59, pls. i. 3, and iii. 14–14 b [details].

Imago (*dried*), ♂.—Pronotum piceous, the remainder of the notum (perhaps modified by gum) luteous. Abdomen beneath and at the sides of the back light yellow-ochreous,

becoming darker in segments 8–10; the remainder (midst) of the back chiefly blackish-grey, having joinings 1–3, and a small elongated spot on each side in segments 4–8 pale; joinings 4–7 darker grey. The dark colour projects obliquely downwards as a line from the hind border in segments 1 and 2, and as a short stripe bounded in front by a pale line ascending from the spicular border in segments 3–5 or –6; the same dark colour, in segments 6– or 7–10, occupies nearly the whole dorsal surface, but the same pale lines from the spicular border project upwards into it in segments 7–9. Setæ white, tinged very faintly with light grey near the base. Fore legs blackish-grey, with pale joinings; hinder legs luteous. Wings transparent, their neuration pale distally, but nearer the base (the costa, subcosta, and radius especially) tinged with violet-grey; the same colour imparts a light tint in the fore wing to the proximal portion of the marginal and submarginal areas, and also to the space enclosed by the first axillary and the inner margin. Length of body 8, wing 10, setæ 35 mm.

Hab. Pará (Brit. Mus.).

Campsurus decoloratus, Hag.

Palingenia decolorata, ! Hag., Smithson. Miscell. Coll. (1861), Synop. Neuropt. N. Am. 43.
Hexagenia decolorata, Etn., Trans. Ent. Soc. London (1871), 65.

Imago (*in alcohol*).—Luteous; antennæ pale; mesothorax yellowish-fuscous; abdomen striped at the sides with obscure fuscous; setæ luteous. Fore legs blackish; hinder legs luteous. Wings transparent, yellowish; neuration luteous, excepting the fuscous subcosta of the fore wing. Length of body 16, exp. of wings 30, setæ about 30 mm.

Hab. Mexico; Matamoras, Tamaulipas, common (Mus. Comp. Zool. Cambridge, Mass.). [After Hagen.] The specimen seen by me was a female. Specimens from the same localities could be readily identified by the colour of the fore legs, and by the dimensions &c. quoted. In McLach. Mus. are several ♀ examples of a *Campsurus* taken by Belfrage in Bosque Co., Texas, which has the fore legs yellowish like the hinder legs.

The fore wing of this Texan species is figured by me in Trans. Ent. Soc. London (1871), pl. i. 3, the hind wing in the present work (Pl. V. 8 b). In the absence of the ♂ it is well to leave it undescribed and nameless.

Campsurus dorsalis, Burm.

Palingenia dorsalis, Burm., Handb. d. Ent. Bd. ii. Abth. ii. 803, 1015 (1839); Pict., Hist. Nat. Névropt. ii. Ephém. 153, pl. xiii. 5 (1843–5); Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 549 (1853).
Asthenopus dorsalis, Etn., Trans. Ent. Soc. London (1871), 59.

Imago, ♀ [after Piet.].—Pronotum yellowish, with a violet line or spot in the middle; the rest of the thorax yellow-ochreous at the sides, violet above, with a pair of lutescent lines in the middle. Abdomen ochraceous grey, with a median fuscous streak tapering behind. Setæ whitish. Fore legs black-grey. Wings almost colourless; costal region

of the fore wing violet-fuscous, the nervures in other parts of the wing light fuscescent; neuration whitish in the hind wings. Length of body 11, exp. of wings 38 mm.

Hab. Brazil (Burm.; Piet. in Vienna Mus.).

JOLIA, Etn. 1881.

Illustrations. Alleged *Adult*, Pl. II. 9 (details). *Nymph*, Pl. XXVII. (whole figure and details): see also citations of figures by Joly and Vayssière under *J. Rœseli.*

Adult.—Discal cellules of the fore wing moderately small, subquadrate; neuration, as a whole, very similar to that of *Polymitarcys.* ♂, fore leg about as long as the head and body together, the tarsus shorter than the femur, which is more than $\frac{1}{2}$ as long as the tibia; tarsal ungues unequal, dissimilar, narrow, long and flaccid (probably subim.). Spiracles mutilated in the types. Setæ 2; in ♀ about $\frac{1}{2}$ or $\frac{1}{3}$ as long as the body, glabrous, excepting near the tips, and there minutely puberulous; in ♂ (subim. ?), nearly as in *Campsurus* subim. Eyes of ♂ (subim. ?) large, mutually approximated above, rounded, excepting at the inner orbit, and there somewhat flattened or straight; anterior ocellus rather smaller than the others. Forceps-limbs sessile upon the distal border of the 9th ventral segment; the proximal joint (subim. ?) short and largely dilated (perhaps = a divided ventral lobe), the 2nd joint the longest; integument transversely rugose and puberulose. Penis exposed, without apparent stimuli. Lateral margins of the abdominal segments somewhat flattened out in a small degree; the hinder lateral angles of the 9th segment of the ♂ produced into a short tooth-like spine, those of the other segments acute or subrectangular, not produced. Duration of subimago stage (*fide* Joly) about 30 minutes; last moult complete. *Nymph* predatory, agile; mandibles tuskless; fore tibia spurred, and strongly setose behind; 7 pairs of abdominal tracheal branchiæ inserted in notches in the hind margins of the segments near their lateral angles on the dorsum, all made alike but unequal in size, each one formed of a single obovate membranous lamina, intersected obliquely by a fine crease or strengthening rib, containing a pinnately branched trachea, and furnished at its hinder base with a fascicle of filaments; margin of the lamina minutely serrated. Setæ about $\frac{7}{10}$ as long as the body, the median plumose and the outer ciliated on their inner sides for upwards of half their length, and then tail-pointed. Palpi of both maxillæ 2-jointed.—Head relatively small, narrower than the thorax. Antennæ long and slender, setaceous and multiarticulate, the first two joints the stoutest. Labrum ciliate in front, hispid on the outer surface. Mandibles broad, their two fangs slender and acute, the innermost appendaged, and distant from the molar protuberance. Lacinia of 1st maxilla rounded and pilose externally, subtruncate and ciliate within, acutely pungent; stipes furnished with a small fascicle of tracheo-branchial filaments at the base outside; palpus stout, the second joint enlarged and densely pilose, the first joint glabrous. Lacinia of second maxilla semiovate, densely pilose, excepting towards the pubescent apex; palpus stout, the second joint enlarged, densely pilose, and about thrice as long as the first joint. Lobes of the labium well defined, but seemingly coherent, smaller than the laciniæ of the maxillæ. Median lobe of the tongue subrotund; paraglossæ rounded, pilose. Body proportioned

as in *Cloëon* or *Siphlurus*; the legs slender, trailed in the act of natation, which is effected by the setæ only. Fore femur and tibia bearded behind with long stiff hairs, which on the tibia are disposed in two rows longitudinally, and spread divergently; the tibial spur nearly as long as the tarsus, the shin or front of the tibia spinulose; the tarsus slender, bearded beneath. Prosternum at the joining of the head furnished on each side with a tuft of fibrillose tracheal branchiæ.

Distribution. South of France, the Garonne at Toulouse; also N. America, at Niagara.

Type. J. Rœselii (in *Palingenia*), Joly MS.

Etymology. Dr. E. Joly of Toulouse, who first discovered the animal.

JOLIA RŒSELII, Joly. Plate II. 9 (♂ , wings [part], legs, forceps [subim. ?]).

Palingenia tolosana, Joly, MS. (1870). *P. Rœselii*, ! Joly, Mém. Soc. d. Sc. Nat. Cherbourg, xvi. 67, pl. i. 1 [excl. citations] (1872); idem, Bull. Soc. d'Etud. Sc. d'Angers, ann. 4-5e, p. 42, Note C [cited as *P. longicauda*, var.] (1876); idem, Rev. Sc. Nat. Montpellier, v. 309, 314, pl. vi. 3 (1876).

Jolia [type] *Rœseli*, Etn., Ent. Mo. Mag. xvii. 192 (1881). *J. Rœselii*, ! Vayssière, Ann. Sc. Nat. (6), Zool. xiii. 59, figs. 69–73 [nymph details] (1882).

Imago undescribed.—The ♂ specimen given me by Dr. E. Joly, for the British Museum, is in pieces preserved in alcohol. He considers it to be an imago; but the condition of the legs, forceps, and setæ is so nearly identical with that of the corresponding parts in subimagines of *Campsurus* and *Polymitarcys*, that I am not yet convinced of its being the adult fly.

Nymph.—Length of body about 11, setæ 6 and 4 mm.

Hab. The Garonne near Toulouse. The nymph harbours under large stones in swift parts of the river: I have obtained it just below the railway-bridge (pont d'Empalot) above the town. The fly was reared by Dr. E. Joly on 1st September, 1868, who named the nymph *Palingenia tolosana* in a paper read at a meeting of the Soc. d'Hist. Nat. de Toulouse, on the 15th July, 1870, and who altered the name to *P. Rœselii* the next year in another paper communicated to the Cherbourg society, cited above. In the plate illustrative of this later paper Dr. Joly reproduced four figures from older authors, which he tabulated as nymphs congeneric with *Jolia*, and in one instance identical with the French nymph. These are respectively, fig. 2 (after Swammerdam), *Palingenia longicauda*; fig. 3 (after Réaumur), *Cloëon rufulum*; fig. 4 (after Rœsel), a *Siphlurus*; and fig. 5 (after De Geer), a *Siphlurus*. Of these figures, nos. 3–5 had never before been supposed to represent any thing akin to *Palingenia*, and their citation as illustrative of species near of kin to *Jolia* is not only misleading, but also very depreciatory of the novelty of Dr. Joly's discovery. Réaumur's figure of the *Cloëon* and Rœsel's of the *Siphlurus* are not quite accurate, so far as they go; but their general effect is characteristic, and the accompanying letter-press affords additional means of ascertaining what were the subjects intended to be represented by them. De Geer's description is also conclusive.

POLYMITARCYS, Etn. 1868.

Illustrations. Adult (details), Pl. VI. 10 a-c; (whole figures) see citations under *P. virgo* and the other species, especially *Palingenia virgo*, Piet., Hist. Nat. Névropt. ii.

Ephém. pl. xi. *Nymph*, Pl. XXVIII. (whole figure and details); see also citations under *P. virgo*, especially of Réaumur (1742), Joly (Sept. 1876 and 1878), and Vayssière (1882).

Adult.—Discal cellules of the fore wing small and subquadrate; in the vicinage of the terminal margin the axillary nervures and the proximal branch of the anal nervure are strong, but in the neighbourhood of the fork of the anal nervure the neuration often assumes a feebler and rather closely reticulated texture; the nervures interposed between the anal (8) and pobrachial (7), or some of them, are liable to lose themselves in this reticulation on approaching the basis of the anal nervure, and nowhere in the wing are the nervures especially fasciculated. Fore leg of ♂ about as long as the head and body together, the tarsus much (3–5 times) longer than the femur, which is not $\frac{1}{4}$ as long as the tibia; the ungues nearly coequal, narrow, long, and flaccid. Aperture of the anterior thoracic spiracle ovate, narrowed below; that of the posterior spiracle ovate, narrow and elongate. Setæ in ♂ 2, in ♀ 3, equal; in the former sex about three times as long as the body, glabrous from the base nearly to the tip, and divaricate in the dried insect; in ♀ about $\frac{3}{4}$ as long as the body, and pubescent. Eyes of ♂ relatively small, oval, mutually remote; anterior ocellus much smaller than the others, which are unusually large in comparison with the eyes. Forceps-limbs sessile upon the border of the segment; the proximal joint short, somewhat compressed; second joint the longest. Penis exposed, the lobes straight, unarmed. Hinder lateral angles of the abdominal segments subrectangular. *Nymph* fossorial; mandibles tusked; fore tibia strongly bearded and minutely tuberculated behind, spurless; seven pairs of abdominal tracheal branchiæ inserted each on a lateral protuberance, armed with a minute tooth-like tubercle, situated a little in advance of the hinder lateral angle of the segment, arched upwards over the back; the first of the series different from the rest, being single, spathulate, and fringeless; the others mutually alike, double, with uniform unequal divisions,—each moiety a rather narrow, blunt, membranous lamina, folded together lengthwise once, and fringed with short simple fibrils. Setæ about $\frac{1}{2}$ as long as the body, plumose in the greater part of their length, and then tail-pointed. Palpi of both maxillæ 2-jointed.—Head hard, about as broad as the thorax; pronotum quadrangular; terminal margins of the fore wings free; body soft and tender. Antennæ setaceous, many-jointed, the first 2 joints stouter than the others. Labrum well developed, subquadrangular, rounded in front. Tusks of mandibles about twice as long as the head, echinate upon the upper surface, slightly connivent distally, each with a well-defined ensheathing beard of long spreading hair inserted in a curve on the outer base, also with a dense patch of shorter hair just at the commencement of the tubercles, and with some sparse pilosity over the rest of the upper side; the crown and lobes (or fangs) nearly at right angles with the tusk. Lacinia of first maxilla subquadrangular, widened from the base to the obliquely truncate crown, acutely pungent, ciliate at the inner margin, and crowned with a dense long beard: palpus stout and long; the first joint nude, and about $\frac{1}{2}$ as long as the second; second joint externally pilose, on the inner side strongly bearded, tapering from the middle to a point, and slightly curved. Lacinia of second maxilla broadly ovate, oblique, densely pilose: palpus stout; first joint nearly $\frac{2}{3}$ as long as the other, pilose outside in the

middle; second joint compressed, dilated distally, pilose outside, and on the inner side strongly bearded before the tip. Lobes of labium small, approximated to each other above. Tongue small, the median lobe subquadrate, obtusely prominent in the middle of its front edge; paraglossæ rounded, pilose. Fore leg short and strong, bearded and minutely tuberculated beneath the femur at the base, and at the back of the tibia; the tibia with a strongly circumscribed line of oblique spreading beard near its base outside, two rows of tubercles behind, and a single series of erect tactile hairs in front. Hinder legs slightly pubescent, but shortly pilose at the upper extremity of the femur, in front of the tibia, and on the dorsum of the tarsus. The nymph sometimes divaricates the outer setæ, and then their tips are bent so as to point behind. When the subimago alights to moult, the slough is cast off completely in about $\frac{3}{4}$ of a minute, the insect standing upon its four hinder legs, holding its fore legs apart off the ground, and its setæ a little apart from one another.

Distribution. Middle continental Europe southwards to N. Africa; Indo-Malay Region; S. Africa; N. America, from Canada (Niagara) to New Orleans.

Type. P. virgo (in *Ephemera*), Ol.

Etymology. πολύμιτος and ἄρκυς, from the closeness of the reticulation of the wings.

Polymitarcys virgo, Ol. Plate VI. 10 a (♂, head, legs, forceps, wings adult; fore leg subim.).

Hemerobius, Ephemerum, &c.; Clut., Opusc. ii. title-page (woodcut) and pp. 61, 87, 90 (1634); Mey., in Gödart's Metamorph. et Hist. Nat. Ins. i. Append. pp. 193–200 (1662); Blégny, Temple d'Esculape, An. 2e, p. 188 (1680); Targ.-Tozz., Let. sopr. una numeros. sp. dei Farfalle vedut. in Firenze sulla metà di Luglio, pp. 32, frontisp. figs. 1–5 (1741); Réaum., Mém. pour serv. à l'hist. des Ins. vi. 457–522, pls. xlii.–xliv. (1742); Schæf., 'Das fliegende Uferaas oder der Haft,' &c., p. 34 (1757); idem, reprinted in Abhandl. von Ins. iii. 30, pl. i. (1779); idem, Ic. Ins. Ratisb. ii. pl. clxxv. 1–3 (1776).

Ephemera virgo, Ol., Enc. Méth. vi. 419 (1791); Lat., H. N. xiii. 98 (1805); idem, Nouv. Diet. H. N. x. pl. xix. 5 (1817).—? *E. marocana*, Fab., Ent. Syst. emend. iii. pars i. 69 (1793).—‡*E. lutea*, Seetzen, in Meyer's Magaz. f. d. Thiergesch. i. 41–3 (1794); Pz. in Explic. Schæf. Ic. clxxv. (1804).—‡*E. albipennis*, Voigt, Lehrbuch d. Zool. v. 309–11 (1840); Blanch., H. N. Ins. iii. 54, pl. iii. 1 (1840); Ramb., Névrop. 296 (1842).

Palingenia ‡*horaria*, Burm., Handb. Bd. ii. Abth. ii. 802 (1839); idem, in D'Alton. Zeit. f. Zool. &c. i. xiv. pp. 109–12, t. i. 1–12 (1848); Hag., Stet. ent. Zeit. xxvi. 229 (1865); Leunis, Synop. d. Naturgesch. d. Thierreichs &c. ed. ii. p. 635 (1860); Loew, Verh. zool.-bot. Gesellsch. Wien, xvi. 947 (1866).—*P. virgo*, Pict., Nat. Hist. Névropt. ii. Ephém. 141, pl. ix.–xi. 3 (1843–5); A. & G. B. Villa, in Economista, p. 1–6, illustrat. (1847, November); Walk., List of Neurop. Ins. in Brit. Mus. part iii. 547 (1853); Letzner, in Arbeit. schles. Gesellsch. p. 101 (1854); Brau., Neuropt. Aust. 25 (1857); Karsch, Die Insectenwelt, v. 100–1 (1863); Oulian., Neuropt. &c. of Moscow, p. 26 (1867); Ausserer, Annnar. d. Soc. Natur. Modena, An. iv. 132 (1869); N. Joly, Mém. Acad. Sc. Inscript. Belles-Let. Toulouse (7), iii. 379–386 [development] (1871, Sept.); ditto, Ann. Sc. Nat. (5), xv. Art. x. pgs. 5 (1871-2); ditto, Compt. Rend. lxxxi. 809 (1875); ditto, Robin's Journ. Anat. and Physiol. xii. 486–95, pls. i.–ii. (1876, Sept.); ditto, Rev. Sc. Nat. Montpellier, v. 305–330 (1876, Dec.); ditto, Bull. Soc. d'Et. Sc. d'Angers, 1874–5, p. 40, note A (1876); idem, Compt. Rend. lxxxiii. 809 (1877); ditto (translated), Ann. & Mag. Nat. Hist. (4), xix. 193–5 (1877); idem, Mém. Acad. Sc. Inscript. & Belles-Let. Toulouse (separate), 10 pgs. pls. i.–ii. [development] (1878); idem, Bull. Soc. d'Et. Sc. d'Angers, 1878–9, p. 171 (1880).

Polymitarcys [type] *virgo*, Etn., Ent. Mo. Mag. v. 81 (1868, Aug.); Trans. Ent. Soc. Lond. (1871), 60, pl. i. 5 & iii. 15–15 *b* [details]; Palmén, d. Morphol. d. Tracheensyst. sect. i. pp. 1–21, taf. i. 1–7 (1877); Mocsary [vide *Ephemerum* under citations for *Palingenia longicauda* (1878)]; Rostock, Jahresber. d. Ver. f. Naturk. Zwickau, 1877, p. 81 (1878); Vayssière, Ann. Sc. Nat. (6), Zool. xiii. 43, figs. 9–12, & 80–80 bis [nymph] (1882).

Adult (*in life*), ♂.—Head whitish, tinged with grey above, the oculi and bases of the ocelli black, the hinder ocelli met interiorly by a fine curved fuscous line. Pronotum whitish, clouded more or less with grey, and on its front edge in two places on each side tinged with sepia-grey. Meso- and metathorax pale brown-ochreous or lutescent, their peaks and the decurrent membranes of the wing-roots whitish. Abdomen whitish, the dorsum clouded more or less with grey, especially at the tips of the segments, the last two ventral segments and the penis somewhat ochroleucous. Setæ and forceps white, the former pellucid, with opaque joinings. Wings white, the costa, subcosta, and radius of the fore wings grey. Legs white, the fore legs with a longitudinal streak from the base outside the coxa, the femur (all but the back of the knee) and the tibia blackish. The body of the ♀ is more completely pale brown-ochreous, before the eggs are discharged; afterwards the emptied abdomen is of a pale warm sepia-grey. Length of body, ♂ 10–11, ♀ 16–17; wing, ♂ 11–12, ♀ 16; setæ, ♂ im. 30–33, subim. 16, ♀ adult 13 mm.

Hab. In Europe, from Madrid, France, and the Netherlands, eastwards, inhabiting the chief rivers (*e. g.* the Seine at Paris, the Rhône at Lyons and Avignon, and the Garonne at Toulouse); perhaps in Morocco as well. During the last and the first quarters of the moon at the end of August and the early part of September, "la manne" occasionally swarms late in the evening over the water. Dr. E. Joly narrates the invasion of a milliner's shop by them at Toulouse,—the flies thronging to the gas-burners and actually quenching the flames. Pictet's figure of the ♂ fore leg is incorrect; he has given a fifth joint to the tarsus (seemingly by dividing the first joint) and has exaggerated the inequality of the ungues. Doubtless his subjects were dried.

Polymitarcys Savignyi, Pict.

Ephemera, Sav., Descript. de l'Egypt. Hist. Nat. i. 194 [explic. ic.], ii. Névropt. 5 (1817).

Palingenia Savignyi, Pict., Hist. Nat. Névropt. ii. Ephém. 157 [undescribed] (1843–5); Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 550 [undescr.] (1853).

Polymitarcys Savignyi, ! Etn., Trans. Ent. Soc. London (1871), 61, pl. iii. 16, 16 *a* [details].

Imago (*dried*), ♂.—Pronotum warm sepia-grey, with a longitudinal median line and the front and lateral edges black; meso- and metathorax light brown-ochreous, probably varied above with warm sepia-grey (the specimen is eroded). Abdomen beneath and at the sides of the palest yellow ochre, becoming light brown-ochreous in segments 8–10; above, segments 1–7 are broadly shaded with light Vandyke-grey, with the edges of the dorsal vessel darker, and the joinings broadly whitish; in segments 8–10 the grey gives place to light Vandyke-brown, which in certain positions changes to violet-grey, and the sides of the segments are concolorous with the venter. Setæ and forceps white. Fore femur above, and the tibia, viewed in certain directions, violet-grey; the tarsus whitish; hinder legs with very pale yellow-ochreous femora, and the remaining parts whitish.

Wings transparent white, with opaque neuration; the costa, subcosta, and radius of the fore wing, up to the commencement of the pterostigmatic space, tinged with light purplish or violet-grey; a faint tint of the same colour is perceptible in the contiguous areas. Length of body 10, wing 11 mm.

Hab. The Nile, Egypt (Pictet & M'Lachlan, Mus.). The only example in this last collection was given to me by M. Pictet.

POLYMITARCYS INDICUS, Pict.

Palingenia indica, Pict., Hist. Nat. Névropt. ii. Ephem. 151, pl. xiii. 4 (1843–5); Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 549 (1853).

Polymitarcys indicus, Etn., Trans. Ent. Soc. London (1871), 61.

Subimago (*dried*), ♀.—Body in great measure ochreous, with a fuscous spot in the midst of the pronotum, three longitudinal fuscous lines (coincident with the sutures?) on the mesonotum,—one in the middle, the others directed towards the wing-roots,—and a broad violet dorsal stripe along the abdomen. Setæ ochraceous. Fore legs ochraceous, the tibia and a streak on the femur blackish; hinder legs white. Wing-neuration white; the fore wing tinted slightly with violet along the costa. Length of body 12, exp. of wings 30 mm. (After *Pictet.*)

Hab. East Indies (Vienna Mus.).

POLYMITARCYS ALBUS, Say.

Ephoron leukon, Will., Trans. Am. Soc. Philad. v. 71–3 (1802); Etn., Trans. Ent. Soc. London (1871), 124.

‡*Baetis alba*, Say, West. Quart. Rept. ii. 305 (1823); Le Conte, Complete Writings of T. Say, i. 204 (1859); Hag., Proc. Ent. Soc. Philad. ii. 170 (1863); Walsh, op. cit. ii. 193, note 12 [in *Cloë* A] (1863). —*B. albus*, Etn., Trans. Ent. Soc. London (1871), 124; Hag., op. cit. (1873), 390.

? *Palingenia puella*, Pict., Hist. Nat. Névropt. ii. Ephém. 145, pl. xi. 4, 5 (1843–5); Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 548 (1853); Hag., Smithson. Miscell. Coll. (1861), Synop. Neuropt. N. Am. 40.—*P. alba*, id., op. cit. 40 (1861); id., Trans. Ent. Soc. London (1873), 391.

? *Campsurus puella*, Etn., *op. cit.* (1871), 58.

Imago.—Milk-white; pronotum yellowish white; fore legs greyish fuscous; hinder legs white; wings whitish, the fore wing greyish along the costa. Length of body 11–12; exp. of wing 22 mm.

Hab. Passaick river, Belville, New Jersey (*Williamson*); Winnipeg river (*Say*); North Red River and N. York (*Hagen*).

Second Series of Group I. of the Genera.

Adult.—Legs all functional, the hinder pairs rather short, the fore legs the longest pair in the ♂, and in the ♀ at least as long as the hind legs, but usually a little longer than these; femora shorter than the tibiæ; ungues efficient, unequal, those of the hinder tarsi mutually dissimilar. Valves of the thoracic spiracles straight-edged, usually closed in dried specimens. Proximal joint of ♂ forceps-limbs short, the second joint the longest. *Subimago* quiescent during many hours; the fore legs smooth; the last moult complete. *Nymph.*—Palpus of first maxilla long and slender, curved and 3-jointed. The 2-jointed palpus of second maxilla, dilated terminally and geniculated.

Section 3 of the Genera.—Type of *Ephemera*. *Adult.*—Wing-neuration complete and plentiful; in the fore wing the subcosta is displayed, the anal (8) is unequally sinuous, and, together with the second axillary nervure (9^2) and the inner margin, encloses an almost semi-sagittate space; the first axillary nervure (9^1) is strongly arched towards its extremity; the second is essentially simple and very gently curved. Hind wings well developed, their membrane devoid of a contracted longitudinal fold. Setæ of moderate length in ♀, very long in ♂; in dried examples the outer setæ of ♂ are divergent from the median setæ (when there are three) or divaricate (when the median is aborted). Forceps-limbs inserted at the sides of the terminal border of a short transverse laminar lobe prolonged from the segment, which lamina is undeveloped in the ♀, their proximal joint shorter than the second, which is the longest joint. *Nymph* [*Pentagenia* (13) unknown] fossorial, with tracheal branchiæ inserted upon the sides of the respective segments in advance of the unprolonged hinder lateral angles, and arched upwards over the back with the tips turned posteriorly; median lobe of tongue emarginate. Legs short and strong; the fore tibia and femur pilose, the former compressed and obliquely truncate distally.

HEXAGENIA, Walsh, 1863.

Illustrations. Adult. Pl. VII. 11 *a*–11 *c* (details); (whole figures,) see citations of Guérin (1829–31), Gray (1832), and Rambur (1842), under *H. bilineata*; also of Pict. (1843–5) under *H. variabilis*. *Nymph* Pl. XXIX. (whole figure and some details) and Pl. LXIII. (other details); also Walsh, 'American Entomologist,' i. 6, woodcut (1868).

Adult.—Pronotum in ♀ longer than broad, enlarged posteriorly, inflated medially, slightly constricted at its anterior $\frac{1}{3}$ at the sides; its arched and curved hinder border rather prominent just in the middle, and somewhat retuse when dried. Fore leg of ♂ nearly as long as the body, the tibia about $1\frac{1}{3}$, the tarsus about $1\frac{2}{3}$ as long as the femur; ♀ fore femur but little shorter than the tibia, which is about as long as the tarsus. Thoracic spiracles elongate, their lips straight-edged or nearly so, usually closed in dried specimens; but sometimes the anterior gapes narrowly in front; its upper valve is much the larger and is strongly concave within. Median seta extremely rudimentary in both sexes; outer setæ generally upwards of $2\frac{1}{2}$ times as long as (in subimago about the same length as) the body, in ♀ about $\frac{2}{3}$ as long as it; when magnified their surface is minutely pubescent throughout, and their joinings are well defined. Terminal joints of forceps-limbs small. Lobes of penis strongly hooked, and without apparent stimuli. Abdominal segments of ♀ :—1 and 2 very short, the first thoracoid; 3–6 rather short, 7–9 longer, 10 short; 8 is the longest, and 9 about as long as 7. Anterior ocellus much smaller than the others. Eyes of ♂ suboval, curved, large, moderately distant from each other above. *Nymph* in the construction of its tracheal branchiæ, legs, and mouth-parts very similar to *Ephemera*; but the tusks of the mandibles are connivent, and the frons is armed with a single obtuse median protuberance. Abdominal segments 1–7 branchiferous; the gills all double, those of the anterior segments arising each from the upper surface of the pleural region of the segment in the hinder part of the same, but the gills of the seventh segment issuing from it near the base; the gill-roots armed (as

in several other burrowing nymphs) each with a minute tubercle; the divisions of the minute gills of the first segment are linear and fringeless; those of the gills of the other segments are larger, and are flat, ovate-lanceolate, acuminate, fringed, membranous laminæ. Wings adnate to the notum along their inner margins only. Pronotum large, quadrangular, ciliated at the sides, which are nearly straight; its border in front and behind slightly thickened, and armed at the fore corners with single triangular points projecting forwards. Setæ acuminately plumose, a little more than half as long as the body. Ventral segments 7–10 of the abdomen, taken together, are about $1\frac{1}{3}$ as long as the rest put together.

Type. H. bilineata (in ‡ *Baëtis*), Say.

Distribution. America, from Canada to Brazil; also India.

Etymology. ἕξ and γενεά, on account of its being the sixth of the Sections of *Palingenia auctorum* defined by Hagen in 1863, and named by Walsh in that year.

The species of this genus and of *Ephemera* might be described concisely from living specimens.

Hexagenia albivittata, Walk.

‡*Baëtis albivitta*, ! Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 566 (1853).
Palingenia continua, ! id., Trans. Ent. Soc. London, n. s. v. 199 (1860).—*P. dorsigera*, ! Hag. MS. (1861).
Hexagenia albivitta, ! Etn., *op. cit.* (1871), 64, pl. iv. 2, 2 *a* [details]; Hag., *op. cit.* (1873), 392.

Subimago (*dried*).—Wings transparent pale smoke-grey with opaque black neuration; but the main nervures are pale near the base of the wings and in the hinder portion of the disk of the hind wings, with the exception of the subcosta of the hind wing, which is black up to the wing-roots.

Imago (*dried*).—Body above snow-white varied with black; the black forms a broad longitudinal stripe on each side of the pronotum, and encloses a large somewhat mitriform blotch on the meso- and metanotum; white predominates upon the dorsum of the abdomen, leaving a serrated black stripe above the spiracular line on each side (composed of a series of triangular spots, each with its hypotenuse descending obliquely from the hinder margin towards the lower anterior angle of the dorsum of the segment) and enclosing some small black intermediate markings in the anterior portion of some of the segments, viz.:—in both sexes a short longitudinal linear streak adjacent to the dorsal vessel in the last few segments, and in the ♀ in each of the segments 3–6 a pair of similarly situated triangular streaks, whose apices coalesce somewhat with the tips of the serratures of the lateral stripes; venter pale dull reddish sepia-brown with a longitudinal median testaceous streak, and with darker tips to the segments, or, in very faded specimens, pale dull lutescent with the overlapping borders of the segments paler. Setæ either fawn-colour banded with brown, or brownish with irregular dull yellow-ochreous bands. Wings in ♂ perspicuous, faintly tinted with very pale sepia-grey, paler in the ♀; neuration pitch-black. Legs in ♀ lutescent, the hinder tarsi with the terminal joint and ungues, and the extreme apical borders of the paler other joints reddish sepia-brown: the fore legs in ♂ fuscescent, with all of the tarsal joints but the last black. Length of body 15; wing, ♂ 15, ♀ 17; setæ, ♂ im. 35, subim. 23 mm.

Hab. Buenos Ayres (*Hag.*); the Amazons Region (*Walk.*); Espirito Santo (McLach. Mus.).

Hexagenia mexicana, sp. nov.

Imago, ♂ (*dried*).—Wing-membrane transparent pitch-brown throughout, with black neuration, the hind wings rather the darker pair; most of the longitudinal nervures and cross veinlets are narrowly bordered with blackish, and this edging is widened along the cross veinlets in the midst of the wings; but the costa, subcosta, and radius, with their interjacent cross veinlets are not bordered in the fore wings. Thorax opaque pitch-brown; the pronotum with a broad longitudinal black stripe on each side. Abdomen discoloured; setæ brown-black; forceps pale, blackened towards their extremities. Fore legs with pitch-brown femur and tibia, the tarsus pitch-black; hinder legs flavescent, the femora towards their distal extremities, the borders of the extremities of the tibia and tarsal joints, the plantar surface, the last tarsal joint and the ungues, tinged more or less with pitch-brown. Length of wing 13 mm.

Hab. Mexico (Hagen Mus.), captured by Sallé; formerly represented in Baron de Selys-Longchamps's collection.

Hexagenia bilineata, Say. Plate VII. 11 *b*, 11 *b'* & 11 *b* ? (wings [part] and forceps).

‡*Baëtis bilineata*, Say, Godman's West. Quart. Rep. ii. 303 (1824); Le Conte, Complete Writings of T. Say, i. 203 (1859).—*B. angulata*, ! Walk., List of Neurop. Ins. in Brit. Mus. part iii. 564 (1853).

Ephemera limbata, Serville MS., Guér. Iconograph. Règ. Anim. ii. part 1, pl. lx. 7–9, texte, iii. 384 (1829–31); Gray, Grif. Cl. Ins. ii. pl. xciv. 7 (1832); ! Ramb., Hist. Nat. d. Ins. Névropt. 295, pl. viii. 2 (1842).

Palingenia viridescens, ! Walk., *op. cit.* iii. 550 (1853).—*P. occulta*, ! id., *op. cit.* iii. 551 (1853); Hag., Smithson. Miscell. Coll. (1861), Synop. Neuropt. N. Am. 43.—*P. limbata*, id., *op. cit.* 43 (1861); Provancher, Natural. Canad. viii. 265 (1876); id., Fn. Ent. d. Canad. ii. fasc. i. 82 (1877).—*P. bilineata*, Walsh, Proc. Acad. Nat. Sc. Philad. (1862), 373; Hag., Proc. Ent. Soc. Philad. ii. 174–5 (1863); Walsh, *op. cit.* 189 & 199 (1863).

Hexagenia bilineata, Walsh, *op. cit.* ii. 199 (1863); ! Etn., Trans. Ent. Soc. London (1871), 66, pl. iv. 4 [detail]; ? Hag. MS., ! Lintar in 10th Ann. Rep. N. Y. State Commission of Fisheries, p. 3, pl. ii. 6 (1878).

Subimago (*dried*).—Wings transparent grey, with pitch-black neuration, the longitudinal nervures occasionally tinged with brown-ochre or bistre-brown close to the wing-roots; hind wings, as a rule, from just before the tip to the commencement of the inner margin bordered with dark grey in ♀, or black in the ♂, and sometimes with several of their cross veinlets near the midst of the wing edged with a like colour.

Imago (*dried*), ♂.—Pronotum bistre-brown, or sometimes pitch-brown, with a broad longitudinal dark bistre-sepia-brown, or sometimes pitch-black stripe on each side, which is extended upon the mesonotum to at least the wing-roots; mesonotum for the most part rufo-luteous or rufo-piceous, with the peak often pitch-black, and sometimes less rufescent on its hinder slopes, rarely of a uniform pitch-brown throughout; metanotum, as a rule, pitch-brown, but sometimes rufo-lutescent or even light brown-ochreous with the peak pitch-brown. Abdomen variable in depth of colour and definition of markings,

the ground-colour ranging from very light yellow-ochreous, or very light Mars-yellow, to light yellowish raw-umber; and the markings from pitch-black and intense burnt-umber brown to a slightly yellowish modification of intense Roman sepia-brown, approaching raw umber. The dominant pattern of the darker markings is, on the dorsum, a median longitudinal stripe and a diagonal lateral stripe extending from the stigma to the hind margin of every intermediate segment; that on the venter, in nearly every segment, is a pair of stripes extending, one on each side, from the hinder angles of the segment (or thereabouts) to the base of the segment, convergent towards each other, and in indirect continuity with the oblique dorsal stripes of the following segment. Some examples simply display this dominant pattern, and in them the light ground-colour in segments 2 to 8 is shown on each side of the median stripe in the form of two right-angled triangular spots occupying the upper anterior and the lower posterior halves of the space diagonally intersected by the lateral stripe; in segment 9 the lower posterior compartment is obscured; segment 10 has a small dark spot at the base in the middle, and no lateral stripes; the midribs of the subanal lobes are pitch-black. This dominant pattern undergoes the following modifications in individual specimens. The median stripe in segments 2–5 is dilated posteriorly so as to form a triangular spot in every segment; the triangular compartments of the quadrangular areas on each side of the median stripe have the angles adjacent to the diagonal stripes filled up with the dark colouring, so as to restrict the lighter ground-colour to oval spots above and ovate or linear spots below the diagonals, or to quadrangular spots in the anterior segments, and semiovate spots in the hinder segments above the diagonals, and a narrow bordering along the spiracular margin below the diagonals; in some examples the pale colouring below the diagonals is restricted almost completely to the hinder lateral angles of the dorsum; the additional colouring is apt to convert the latero-dorsal markings on each side into a broad zig-zag or serrated stripe. On the venter, the spaces included by the two convergent stripes, and the hinder border of nearly every segment are sometimes suffused with the darker colouring, leaving a light-coloured triangular space on each side of the segment external to the stripes; when this is not so, the stripes are sometimes dilated behind. There are often dark spots at the ganglia. Setæ variable in colour, their joints either uniformly or in a large measure bistre-, burnt-umber, or warm sepia-brown, often pale or light-ochraceous anteriorly, sometimes lighter at the joinings only, rarely dark and opaque at the joinings; all of the joints in the same individual specimen are much alike in coloration. Fore leg from trochanter to ungues usually in opaque view dark burnt-umber, changing with transmitted light to madder-brown, the first tarsal joint, the ends of the other tarsal joints and that of the tibia opaque; sometimes they are pitch-brown, or even bistre-brown, with the whole of the tarsus lighter and changing with transmitted light to warm sepia-grey; sometimes the basal portions of the intermediate tarsal joints are in a large measure whitish ochraceous, or the tarsus is nearly uniformly sepia-grey; one example has the tibia pitch-brown, black at the tip, the trochanter and femur intense bistre-brown, lighter above towards the base of the femur, and the tarsus light bistre-brown, with the first and terminal joints and the extremities of the intermediate joints pitch-black, the bistre changing in transmitted light to raw umber. Hinder legs in opaque view, flavescent

or light yellowish ochraceous; changing in transmitted light to light yellowish amber; the ungues, the terminal joint and the distal borders of the other joints of the tarsus, warm sepia, burnt-umber brown, or pitch-black, the dark colouring in the intermediate joints of the tarsus sometimes predominating almost to the exclusion of the light ground-colouring, at other times narrowly restricted to their terminal borders. Wing-membrane usually quite clear in the disk, bistre- or raw-umber brown in the marginal and submarginal areas of the fore wing, and narrowly grey or intense sepia along the terminal margin of the hind wing; but sometimes even those areas in the fore wing from the wing-roots to the pterostigmatic space are colourless, and the bordering of the terminal margin of the hind wing is either limited to a faint spot at the apex of the wing or is entirely deficient. The cross veinlets, which are liable to be bordered with black or grey in the subimago, are apt to exhibit corresponding greyish markings in the imago. Individual specimens occasionally have the greater portion of the wing-membrane tinted almost imperceptibly with greyish. Neuration of similar colour to that of the subimago.

The ♀ has the thorax nearly of the same colours as the ♂; the abdomen very light brownish ochraceous or burnt-umber grey, or vandyke-brown, marked with burnt-umber brown in the opaque portion, but with bistre in the empty terminal segments; the median dorsal stripe corresponds in variety of form with that of the ♂, the latero-dorsal stripes are of the broad serrated type, the ventral markings vary as in the ♂. Fore legs usually piceous, either entirely, or with the tarsal joints whitish at their bases; one example has the fore leg bistre-brown, with the terminal tarsal joint and the extreme edges of the others black. Hinder legs, in opaque view, light bistre-brown, sometimes with the tibia and tarsus darker than the femur; the terminal joint of the tarsus and sometimes the terminal borders of the other joints intense burnt-umber or piceous. Setæ light warm sepia-brown with opaque joinings, or sepia-grey with dark sepia joinings. Wings with transparent membrane and pitch-black or pitch-brown neuration, the longitudinal nervures becoming lighter close to the wing-roots; hind-wings commonly, but not invariably, bordered narrowly with dark sepia along the terminal margin and at the adjacent angles, the bordering uneven in its definition along its inner edge; fore wings often almost imperceptibly and narrowly tinted with very light sepia-grey along the corresponding margin, and more distinctly tinted with sepia-grey in the pterostigmatic region; in many examples the marginal and submarginal areas of the fore-wing, anterior to the bulla, are more lightly tinted with the same colour. Cross veinlets in the fore wing between the costa and the pobrachial (7) nervures, and those in the hind wing from the subcosta to the first axillary nervure (9), generally (but not in every specimen) bordered with light or dark sepia-grey; this bordering is usually lighter in colour and narrower in the fore wing than in the hind wing, and frequently forms irregular blots upon the stem of the sector (4), the end of the longest adventitious nervure contained within its fork, and upon the end of the corresponding nervure included within the fork of the præbrachial (6). Length of body, ♂ ♀ 16–23; wing, ♂ 14–21, ♀ 18–22; setæ, ♂ 44–65, subim. 21–25, ♀ 35–40 and 1, subim. 17 mm.

Hab. Generally distributed in North America, in lakes and rivers, from Louisiana

and Texas northwards, and from the Atlantic to the Pacific. June (or May in the South) to September.

HEXAGENIA MUNDA, sp. nov.

Imago (*dried*), ♂.—Thorax above light raw-umber, with a broad pitch-brown or intense sepia longitudinal stripe on each side of the pronotum, narrowly and less distinctly produced backwards nearly to the peak of the mesonotum; the tegulæ of the fore wings and the pectus and sides of the prothorax, together with the fore coxæ, yellow ochreous; metanotum partly piceous; intermediate coxæ in front and the fore part of the mesosternum piceous, or intense warm sepia; a lighter spot of the same colour occupies the joining of the meso-, and metasternum. Abdomen very light yellow ochraceous, marked with pitch-black above, and light burnt-umber beneath: the dorsal markings in segments 1–7 are a pair of broad stripes rising obliquely upwards from the base of the dorsum near the anterior lateral angles, one on each side of the back, rounded off posteriorly just before the distal border of the segment, and joined to each other in front and behind by a streak (in the anterior segments), or narrow band (in the hinder segments), of the same colour as the stripes, running respectively parallel with and adjacent to the joining and the apical border of the segment,—in short, a mark like the letter U closed by a line across the top, with arms of equal thickness; in segment 7 a broad longitudinal stripe occupies the middle of the space thus enclosed, whereas in the preceding segments only the dorsal vessel is there visible as a greyish line: segments 8 and 9 differ from segment 7 in their markings failing towards the anterior lateral angles of the segments. Ventrally, in segments 1–7, a light burnt-umber spot semielliptical in the hinder, but in the form of a small segment of a circle in other segments, extends almost across the whole of the apical border of each somite, and thence forwards no farther than the midst of the segment at the utmost, and that only in the anterior segments: in segments 8–10 the predominant colour is bright light brown-ochreous; the ganglionic track is blackened at the base of every segment. Setæ intense bistre-brown, lighter close to their insertion, their joinings very light, and some of their joints lighter anteriorly than at their distal extremities. Fore legs from the trochanter to the first tarsal joint pitch-brown, the trochanter and base of the femur lighter on their inner side; the intermediate tarsal joints pitch-brown distally, but warm sepia-grey in their proximal halves. Hinder legs light yellow-ochreous in opaque view, changing to very light yellow amber in transmitted light; the ungues, terminal joint, and the distal border of the penultimate joint of the tarsus warm sepia-brown or intense burnt-umber. Wings transparent, almost uniformly tinted with extremely light bistre-grey; the marginal and submarginal areas of the fore wing distinctly bistre-grey; the terminal margin of the hind wing very narrowly tinged with light greyish: longitudinal neuration bronzy raw umber-brown, becoming light yellowish at the wing-roots, and in part appearing black in certain lights; cross veinlets black, bordered narrowly with blackish in the same parts of the wings as in *H. bilineata*. Length of body 18; wings 14; setæ 35 mm.

Hab. Morganton N. C. (Mus. Comp. Zool., Cambridge, Mass.).

HEXAGENIA VENUSTA, sp. nov.

Subimago (*dried*), ♀.—Wings dull light brown-ochreous, with black, usually immarginate cross veinlets. Setæ uniformly light brown-ochreous. Legs brown ochreous, with tarsi and the extremity of the fore tibia intense burnt-umber brown.—*Variation.* Tarsi in a large measure concolorous with the rest of the legs; but the ungues, terminal joint, and the extreme distal edges of the other joints of the tarsi, and also a broad band at the extremity of the fore tibia, dark burnt-umber.

Imago (*dried*), ♂.—Thorax either very light yellowish bistre-brown, or light brown-ochreous, varied on the meso- and metanotum with light yellow-ochreous, and with a light purple-madder stripe on each side from the edge of the occiput to the fore wing-roots. Abdomen translucent whitish chrome-yellow in segments 2–8, and then posteriorly darker, marked in light purple-madder with the same pattern as the ♀; but in segments 7–9 the dorsal vessel is edged to a greater or less extent with purple-madder: again, the ventral median stripe is prolonged to the prosternum, and in every abdominal segment but the last two contains a pair of pale dots placed transversely in, or a little behind, the middle of the segment; also at the bases of the respective ventral segments, close to the joinings 2–8 and the spiracular borders, in the extreme anterior lateral angles of the segments, are small triangular light purple-madder spots, one spot in each angle. Setæ marked with nearly the same colours as the abdomen, the purple-madder coinciding in certain cases with the joinings, in others with the distal terminations of the joints, in others with the whole of every fourth joint as well so as to form bands of colour each about a joint and a half in breadth in addition to rings; in one example the bands are nearly two and a half joints broad. Fore legs madder-brown, or purple-madder, with the tibia brighter than the femur, and the tarsus dull, uniformly dark in joints 1 and 5, but whitish towards the bases of joints 2–4. Hind legs translucent whitish chrome-yellow, like the abdomen; the terminal joint and the lower point of the penultimate joint of the tarsus, light purple-madder. Wings transparent, and in a large extent tinted almost imperceptibly with light yellowish, but coloured distinctly with raw-umber in the marginal and submarginal areas of the fore wing (this colour receding slightly from the costa between the cross veinlets in the proximal half of the marginal area so as to leave the membrane clear thereabouts, and not extending nearer to the wing-roots than the great cross vein), and sometimes with a more or less narrow blackish-grey bordering along the terminal margin of the hind wing: neuration of diverse colours, the costa, subcosta, and radius outside the great cross vein of the fore wing dark pitch-brown, the remainder of the longitudinal nervures light yellowish (inclusive of the bases of those three); cross veinlets black, sometimes narrowly edged with blackish in the customary parts of the wings, but not so as to form spots.

♀. Body yellow-ochreous marked with violet-grey, viz.:—with a stripe on each side of the pronotum reaching to the wing-roots; on the dorsum of the abdomen, in segments 1–8 a series of oblique triangular spots, on each side one in every segment, the triangles truncate posteriorly, and in segments 1–4 reaching from base to joining, but in the others not starting from the base of the segment; in segment 9 the corresponding spots are

reversed; also in segments 8 and 9 a broad median longitudinal streak from the base, vanishing beyond the middle of the segment before the joining; also a large spot occupying almost the whole of segment 10: beneath, a ventral stripe, dilated in the metasternum, but linear in the abdomen, and somewhat blackened at the joinings, extends backwards to the ninth abdominal segment; the midribs of the perinæal lobes are of the same dark colour. Setæ uniformly very light yellow-ochraceous. Fore leg light brown-ochreous, the tibia and tarsus rather lighter than the femur; ungues, terminal and first joints, and narrowly the distal margins of the other joints of the tarsus, also the distal extremity and the joining at the knee of the tibia, dark Roman-, or warm sepia-brown. Hinder femora yellow-ochreous or light Mars-yellow, changing in transmitted light to dull yellowish-amber colour; tibiæ and tarsi lighter; the terminal joint and lower distal borders of the next two joints of the tarsus very light purple-madder, the larger of the ungues much darker. Wings more of a dull light-yellowish amber than those of the subimago; their longitudinal neuration light-yellowish ochraceous, or sometimes light Mars-yellow, the cross veinlets, and the great cross vein of the fore wing black, as also are the bullæ of the subcosta and radius. Length of body, ♂ 15–18, ♀ 22–23; wing, ♂ 15, ♀ 17–23; setæ, im. ♂ 44, ♀ 27–28 mm.

Hab. Texas, Dallas, Waco, and W. Texas (*Belfrage*), in May; Utah Lake (in M°Lach. Mus. and Mus. Comp. Zool. Cambridge, Mass.). In 1871, having no ♂ im., I failed to distinguish this species from *H. variabilis*.

Hexagenia variabilis (renamed). Plate VII. 11 *c* (wings, legs and ♂ forceps) [*H. limbata*].

Palingenia ‡ *limbata*, Pict., Hist. Nat. Névropt. ii. Ephém. 146, pl. xii. (1843–5); Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 548 (1853); ! Walsh, Proc. Acad. Nat. Sc. Philad. (1862), 373; Hag., Proc. Ent. Soc. Philad. ii. 176 (1863); Walsh, *op. cit.* p. 199 (1863),—*P.*‡ *bilineata*,! Hag., Smithson. Miscell. Coll. (1861), Synop. Neuropt. N. Am. 41.

Hexagenia [type] ‡ *limbata*,! Walsh, Proc. Ent. Soc. Philad. ii. 197 (1863); ! Etn., Ent. Mo. Mag. v. 85 (1868); ! id., Trans. Ent. Soc. London (1871), 65, pl. i. 7 & iv. 3, 3 *a* [details].

Subimago (*dried*).—Wings of ♂ somewhat greyish, of ♀ dull light yellowish, the marginal and submarginal areas of the fore wing coloured more or less intensely with light bistre-brown or brown-ochreous, and the hind wings in the ♂ along the terminal margin from just round the apex of the wing to the commencement of the inner margin bordered with warm sepia-grey: longitudinal neuration yellowish or very light bistre-grey; cross veinlets black, commonly with dark borders in the usual parts of the wings, these borders narrow and blackish in the fore wing, and rather wider as well as more nearly warm-, or Roman-sepia brown in the hind wings. In some specimens the markings are extensively blurred in the hind wings, imparting a warm sepia-grey cloud to the whole of the membrane excepting at the base of the wing, where the light yellowish tint is stronger than in the fore wing.

Variation, ♀.—Wings free from markings; the membrane uniformly light bistre-grey, very faintly tinted with yellowish in the hind wings; cross veinlets in most of the disk of the fore wings, and those in the hind wings less decidedly blackened than in the ♂;

in certain positions, while the subcosta, radius, and præbrachial nervures of the fore wing remain yellowish, other finer longitudinal nervures appear greyish (Galena).

Imago, ♂ (*living*).—Eyes bright greenish yellow above, black below (*Walsh*).—(*Dried.*) Pronotum translucent, sometimes tinged with bistre-grey overlying yellow-ochre, traversed lengthwise on each side by a light burnt-umber or pitch-brown streak reaching from the occiput to the fore-wing roots. Meso- and metanotum of a colour intermediate between light brown-ochre and Mars-yellow, varied posteriorly with the former colour. Abdomen varying from light yellowish-ochre, or light raw-sienna, to light brown-ochre, marked on the dorsum with dark madder-brown, and on the venter with intense burnt-umber, the form and extent of the markings presenting much variation. In strongly marked specimens the dorsal pattern consists of a median stripe the whole length of the back, with a jagged stripe on each side of it: the median stripe may maintain a nearly even width in every segment; sometimes in segments 1 and 2 the whole of the dorsum (excepting at the joinings) is dark, in segments 3–6 (whose joinings are also pale) the median stripe is narrowed in every segment from behind forwards so as to be resolved into a series of triangular blotches, while in segments 7–9 its breadth is more equal, and it terminates in a spot at the base of segment 10; but in ill-marked specimens both median triangles and stripe are either deficient, or reduced to a linear streak along the dorsal vessel in segments 7–10. The lateral stripes of the dorsum in strongly-marked specimens are each composed of a series of diagonal triangles or of diagonal stripes extended forwards from the hinder borders, nearly in the middle, to the anterior angles of the segments, which stripes in segments 7–9 are sometimes confluent posteriorly with the median stripe; in some specimens the triangles, instead of tapering forwards, are reversed; in ill-marked specimens the stripes are almost linear. Pectus and ganglionic track intense burnt-umber, the latter sometimes ill-defined; in segments 2–9 at each anterior lateral angle is a small triangular spot of the same colour. Setæ light Roman-sepia brown, many of their joints becoming whitish yellow-ochreous anteriorly in varying extent; sometimes the lighter colour is predominant, and, in the midst of the seta, only every fourth joint and more or less narrow annulations at the distal extremities of the other joints remain of the darker colour. Fore leg as an opaque object madder-brown from the trochanter to the end of the tibia, but slightly blackened at the extreme distal border of the femur and at the base of the tibia; tarsus lighter; the terminal and proximal joints of the tarsus, the tips of its intermediate joints, the ungues, and the distal extremity of the tibia, blackish, or intense burnt-umber; viewed with transmitted light the femur and tibia appear fuscescent. Hinder legs as opaque objects very light brown-ochreous, but as transparencies light amber-yellow; the ungues, terminal joint, and the tips of the other joints of the tarsus intense burnt-umber brown. Wings transparent, the fore wings very slightly tinted, the hind wings tinted, sometimes as slightly, sometimes more strongly, with light greenish yellow; the marginal and submarginal areas of the fore wing exterior to the great cross vein, and the longitudinal neuration raw-umber brown, the colouring sometimes receding from the costa towards the subcosta; cross veinlets of the fore wing black, and those in the basal two thirds of the wing between the costa and pobrachial nervure (7)

bordered narrowly with blackish. Hind wing with similarly pale longitudinal and dark transverse neuration, and with nearly all the cross veinlets bordered with blackish; the terminal margin not perceptibly bordered with colour darker than that of the disk. (Texas.)

Variation.—In the fore wing the dark borders to the cross veinlets are obsolete, and those in the hind wing are much reduced in width. Both wings are quite free from all tint of discoloration in the disk; the marginal and submarginal areas of the fore wing are greenish grey or light umber-grey; the terminal margin of the hind wing not bordered with dark colouring. (Washington, D. C.)

Variation.—Both wings are tinted alike throughout in the disk; the marginal and submarginal areas of the fore wing are tinted with umber-brown; the hind wings are bordered with black-grey along the terminal margin: the edgings of the cross veinlets, mostly linear in the hind wing, are obsolete in the disk of the fore wing, but between the great cross vein and the pterostigmatic region of this wing exist as a small rounded spot on every cross veinlet, the roundness of the spots diminishing towards the pterostigma. (Utah Lake.)

Variation.—Wing membrane faintly and uniformly tinted in both wings; no dark bordering along the terminal margin of the hind wing; no bordering perceptible along the cross veinlets of the marginal and submarginal areas, next to none along those in the disk of the fore wing, and hardly any along those of the hind wing. (New England.)

Variation.—Very similar to the foregoing; but some faint indications (as spots) of bordering in the marginal and submarginal areas of the fore wing, narrow sharply defined edging to the other usually bordered cross veinlets, and a grey-black bordering along the terminal margin of the hind wing. Hind legs in their general colouring duller than usual. (Detroit, Mich.)

♀ *imago* (*dried*).—Integument of pronotum translucent very light bistre-grey overlying yellowish-ochre; the rest of the notum, ranging in colour from dark yellow-ochre or dull Italian-ochre to light brown-ochre, is varied with Roman-sepia at the projecting peaks; the light Roman-sepia streak extending backwards on each side of the notum from the occiput is broadest at the hinder part of the pronotum, is much narrowed in front, and is not clearly traceable (though sometimes faintly indicated) on the mesonotum. Dorsum of the abdomen marked longitudinally with a median sepia or warm-sepia stripe, extending from the first segment to very nearly the hind margin of the tenth: in segments 1–5 this stripe is dilated posteriorly so as to form an acutely triangular blotch in each of them; in segment 6 the corresponding triangle is more slender and truncate; in segments 7–9 the stripe in each segment maintains more nearly an evenness of width; but it tapers to a point behind in segment 10. From the median stripe in every segment but the last, on each side of the dorsum, in the vicinage of the hinder border, a tapering streak of a like colour extends obliquely forwards and downwards, either diagonally (as in segments 1–6) or (as in the longer segments 7–9) towards the spiracular border, gradually further and further away from the anterior angle of the dorsum in successive segments. Venter traversed lengthwise, or at least in segments 8 and 9, by a median linear stripe similar in colour to the dorsal markings. Setæ very light yellowish ochraceous. Fore femur

and both extremities of the tibia madder-brown; the rest of the tibia and most of the tarsus in opaque view light brown-ochreous, or in transmitted light yellowish amber-colour, but the ungues, terminal joint, distal borders of the intermediate joints, and the whole of the proximal joint of the tarsus blackish or intense burnt-umber. Hinder legs and wings nearly as in the lighter variations of the ♂, the cross veinlets being immarginate: marginal and submarginal areas of the fore wing uniformly tinted with very light amber-yellow. Length of body, ♂ 14–16, ♀ 18–24; wings, ♂ 13–15, ♀ 17–24; setæ, ♂ im. 36–46, subim. 23, ♀ im. 26, subim. 23–25 mm.

Hab. Widely distributed in the United States: Utah Lake; Texas; Lake Harney, Fla.; St. Louis, Miss.; Galena and Rock Island, Ill.; New Red River; Detroit, Mich.; New England; Philadelphia, Penn.; and Washington, D. C. (Mus. Com. Zool. Cambridge, Mass.; Hag. Mus.; M'Lach. Mus.).

EPHEMERA, Linn. 1746; restricted, Leach, 1815.

Illustrations. *Adult*, Pl. VIII. 12 a–d (details); (whole figures) see citations under *E. vulgata*, *danica*, *lineata*, and *glaucops*, especially those referring to Pictet (1843–5), Curtis (1838), and Stephens (1835). *Nymph*, Pl. XXX.; see also citations under *E. vulgata* of Guérin (1829–43), Gray (1832), Blanchard (1868), and Vayssière (1882); also under *E. danica*, of Pictet [pls. 1 & 2] (1843–5).

Adult.—Pronotum in ♀ somewhat transverse, tumescent above, about as wide as the head behind but narrower in front; the anteriorly convergent lateral borders slightly constricted at about their first $\frac{1}{3}$, and suddenly rounded off at the angles in front and behind; the arched and sinuous hind margin slightly retuse in the middle, and a little everted at the lateral angles. Fore leg of ♂ about $\frac{4}{5}$ as long as the body, tibia $2\frac{1}{2}$ or 3 times as long as the femur, the tarsus about 4 times as long as the femur; ♀ fore femur about $\frac{3}{4}$ as long as the tibia, and subequal in length to the tarsus. Thoracic spiracles straight lipped, relatively smaller than in *Hexagenia*, usually closed in dried specimens, but sometimes the anterior gapes narrowly. Median seta about as long as the others in both sexes; outer setæ in ♂ about twice as long as the body, in ♂ subim. and in ♀ im. nearly of the same length as the body: under a lens they appear pubescent throughout, and their joinings are well marked. Last two joints of forceps limbs well developed. Lobes of the penis usually flattened, and oblique at the ends through prolongation of the thickened outer lateral border, but deviating from this European type in some exotic species; stimuli, when present, inferior, subulate and slender. Abdominal segments of ♀:—1–4 relatively short, the first thoracoid, 5 rather longer, 6–9 long, 10 short; segment 8 is subequal to 7, and rather longer than 9; segment 7 is a little longer than 6; segments 6–10 together constitute about $\frac{2}{3}$ of the abdomen. Anterior ocellus much smaller than the others. Eyes of ♂ oval, their inner orbits curved, mutually remote above. *Subimago* quiescent for about 24–36 hours, standing with erect connivent wings upon its hinder legs, the fore legs prorect off the ground, and the setæ placed close together, the outer either above or below the median seta. *Nymph.*—Head narrowed anteriorly, and armed in front with two conical projections; mandibles tusked, the tusks

subulate, curved slightly upwards and towards their extremities outwards, their tips interlocking when the jaws are closed. Antennæ setaceous; the first two joints the stoutest, the former minutely pubescent, the latter more strongly so; flagellum pilose near the base, with spreading hair disposed in whorls diminishing successively in length, and becoming very short and minute beyond the middle. Wings and gills as in *Hexagenia*. Pronotum slightly narrowed in front and behind, evenly curved at the sides, and armed in front with a strong triangular projection behind each of the eyes. Setæ in a great measure plumose, and then shortly tail-pointed with whorls of minute spreading hair; their length is nearly $\frac{2}{3}$ that of the body. Ventral segments 7–10 together are almost $\frac{1}{2}$ as long as the abdomen.—Labrum quadrangular, rounded at the fore corners, emarginate in front, and pubescent. Lobes (or fangs) of the mandibles adjacent to the molar tuberosity, and set at right angles with the tusk, which is minutely spinulose above for some distance from the base, and partially pilose. Lacinia of 1st maxilla small, narrow, and incurved, terminated by a few spines, strongly ciliated internally, and partially pubescent outside from the middle to the point; the 3-jointed palpus about three times as long as the lacinia, slender; its nude first joint nearly $\frac{1}{2}$ as long as the remainder, the second almost as long as the third, and similarly pilose with spreading hair. Labium and 2nd maxillæ deplanate, the former small, its lobes narrowly ovate and close together. Laciniæ of 2nd maxillæ large and oval; the palpi robust, their first joint flattened, tapering from a wide base, and ciliated within; the second joint incurved, dilated distally, obliquely truncate at the extremity, the truncated surface hispid, the outer surface pilose. Median lobe of tongue semimitriform; paraglossæ rounded, well developed and distally ciliated. Legs pilose along the edges of the femur, the front of the tibia, and the dorsum of the tarsus, and densely hirsute at the back of the tibia; the sole of the tarsus pubescent; the anterior tibia minutely spinulose behind; the femora are compressed, the tibiæ distally dilated and oblique at the ends, where the hind tibia is produced into a spine.

Type. *E. vulgata*, Linn.

Distribution. Northern temperate and Indian regions; also (undescribed sp.) New Zealand.

Etymology. ἐφήμερος (ἐπί and ἡμέρα), from the supposed shortness of life of the imago. Ancient authors in southern Europe probably wrote of *Polymitarcys* under this name, if not of *Oligoneuria*.

I have seen nymphs of *E. vulgata*, *danica*, and *lineata* alive, and of *E. glaucops* and *japonica* in alcohol. In swimming they labour with their legs and progress rather slowly, propelled chiefly by undulations of the body and setæ.

EPHEMERA VULGATA, Linn. Plate VIII. 12 b (wing [part] and penis).

[*Ephemera*] or *Ephemera vulgata* [Linn., Fn. Suec. ed. i. no. 750 (1746); De G., Mém. Sav. Etr. Acad. Paris, ii. 461–9, pl. xvii. 1–2 (1755)]; Linn., S. N. ed. x. i. 546 (1758); idem, Fn. Suec. ed. ii. no. 1472 (1761); Sulzer, Die Kenntz. d. Ins. 43, pl. xvii. 103 (1761); [Geof., Hist. Abr. Ins. Paris, ii. 238, no. 1 (1764)]; Mül., Fn. Ins. Fried. 63 (1764); Pontop., Naturh. Dan. 223, pl. xvii. (1765); Schæf., Elem. Ent. tab. lxii. 1–3 (1766); Linn., S. N. ed. xii. pars ii. 906 (1767); Houttyn, Nat. Beschr. d. Ins.

(1766–9); De G., Mém. d. Ins. ii. pars ii. 621, pls. xvi. and xvii. 1–10 (1771); Berkenhout, Outl. Nat. Hist. Gt. Brit. and Ireland (1769–72); Fab., Syst. Ent. 303 (1775); [Schäf., Ic. Ins. Ratisbon. i. pl. ix. 5–6 (1776)]; Müll., Zool. Dan. Prodr. 142 (1776); Schr., Enumer. Ins. Austr. indig. 602 (1781); Fab., Sp. Ins. i. 383 (1782); Fourc., Ent. Paris, ii. 351 (1785); Fab., Mant. Ins. i. 243 (1787); Berkenhout, Outl. Nat. Hist. Gt. Brit. &c. ed. ii. i. 150 (1789); Vill., C. Linn. Ent. iii. 16 (1789); [Zsch., Mus. Lesk. i. 150, no. 13 (1789)]; Gmél., Linn. Syst. Nat. ed. xiii. i. pars v. 2628 (1790); Ros., Fn. Etrusc. ii. 7 (1790); Ol., Encyc. Méth. vi. 417 (1791); Fischer, Versuch e. Naturgesch. v. Livland, 337, no. 564 (1791); Fab., Ent. Syst. emend. iii. pars i. 68 (1793); Schr., Fn. Boica, ii. pars ii. 196 (1798); Cederhjelm, Fn., Ingric. Prodr. 134 (1798); Walck., Fn. Paris, ii. 8 (1802); Lat., Hist. Nat. Crust. & Ins. xiii. 94 (1805); Panzer, in Explic. Schæf. Ic. ix. 5–6 (1804); idem, Fn. Ins. Germ. initia, Heft xciv. 16 (1805); Shaw, Gen. Zool. vi. part ii. pl. lxxxi. (1806); Lat., Gen. Crust. & Ins. iii. 184 (1807); Leach, Brewster's Edin. Encyc. ix. 137 (1815); Cuv., Règn. Anim. ed. i. iii. 430 (1817); Lamarck, Hist. Nat. d. Anim. s. Vertèb. ed. i. iv. 221 (1817); Stewart, Elem. Nat. Hist. ed. ii. ii. 225 (1817); Cuv., Règn. Anim. ed. ii. v. 244 (1829); Guér.-Mén., Iconogr. Règn. Anim. ii. pars i. t. lx. 8 [aquat.] (1829–43); Gray in Griffith's Anim. Kingd. ii. pl. xciv. 8 [aquat.] (1832); ! Steph., Ill. Brit. Ent. vi. 55 (1835); [! Ronald's Fly-fish. Ent. ed. i. pl. xiv. 30–31 (1836)]; Dahlbom, Kort. Underättel. om Skandin. Ins. 228 (1837); Perch., in Guér., & Perch. Gen. d. Ins. &c. livr. vi. pl. iv. 1 m. (1838); Burm., Handb. d. Ent., Bd. ii. Abth. ii. 804 (1839); Zet., Ins. Lap. 1044 (1840); Voigt, Lehrb. d. Zool. v. 311 (1840); Blanch., Hist. Nat. d. Ins. iii. 53 (1840); Duf., Mém. par divers Savans, Instit. d. France, viii. 580, note (1841); Lat., Nouv. Dict. d'Hist. Nat. x. 348 (1847); ! Walker, List of Neuropt. in Brit. Mus. part iii. 354 (1853); Lcunis, Synop. d. Naturgesch. d. Thierr. ed. ii. 635 (1860); Karsch, Die Insectenwelt, v. 400 (1863); Hag., Ent. Ann. (1863), 14; Stein, Berlin. ent. Zeit. vii. 414 (1864); Hag., Stet. ent. Zeit. xxvi. 229 (1865); Blanchard, Metamorph &c. des Ins. 594 pl. [nec p. 127] (1868); Rostock, Berlin. ent. Zeit. xii. 225 (1868); ! Etn., Trans. Ent. Lond. (1871), 68, pl. i. 9 & iv. 5 (details); Girard, Traité Elem. d'Ent. part ii. fasc. i. (1876); Boulytchoff, Bull. Soc. Oural. Sc. Nat. Ekaterinb. iv. 37 (1878); Rostock, Jahresb. d. Ver. f. Naturk. Zwickau, 1877, p. 83 (1878); Vayssière, Ann. Sc. Nat. (6), Zool. xiii. 38, figs. 3–7 & 53 [nymph and details] (1882).—*E. maculata*, Linn., Syst. Nat. ed. v. p. 62 (1747).—*E. communis*, Retz, C. de G. Gen. and Sp. Ins. 56, no. 180 (1783).—! *E.* ‡ *danica*, Ronald's Fly-fish. Ent. ed. v. no. 31 (1856).

Subimago (*living*).—Wings at first yellowish green or greenish grey, changing to cinereous, broadly tinged with black-grey along the anterior and terminal margins, the discal spots fuscous or piceous, the cross veinlets edged with ivory-black in the male, the neuration dark. Notum ultimately black, but at first varied with luteous, when the pronotum has a black longitudinal stripe on each side, the mesonotum a large rhomboidal luteous spot prolonged at each end into pair of curved streaks, and the luteous metanotum has a pair of L-shaped black marks. Setæ brown-black.

Imago (*living*).— ♂. Head black-brown, the antennæ paler at the base; eyes deep sepia-brown with a pale equator. Pronotum dull greyish olivaceous, with a faint trace of the lateral stripes of the subimago: the joining of the head and prothorax and the pleura of this last, as well as the tegulæ, greenish yellow. Meso- and metanota jet-black. Abdomen very pale olivaceous, with pitch-brown markings, sometimes tinged with luteous or yellow-ochre at the tips, joinings, and in the middle line of some of the hinder segments; the dorsal markings are a pair of curvilinear triangles, broadest at the base of the segment, and ending abruptly at its thickened hinder margin, and a pair of fine curved longitudinal lines interposed between them, which are often effaced; ventral markings, a pair of subparallel fine longitudinal abbreviated black lines, and between them, near the base of the segment, two shorter lines convergent forwards towards one another;

the last segment greenish black above, olivaceous at the sides; eighth and ninth segments often lutescent or ochraceous beneath. Wings pale greenish grey-tinted or yellowish green-tinted with black neuration; many of the cross veinlets away from the terminal margin bordered with pitch-brown, their bordering forming (through confluence) spots in the midst of the fore wing, and a blotch nearer the base of the wing, and also confluent in the submarginal area near the base; hind wings broadly grey-tinted along the terminal margin. Legs olivaceous or olive-brown; fore femur pitch-black, tarsus brownish; hinder tibiæ and tarsi more or less deeply tinged with brown-ochre or lutescent, with the extremity of the last tarsal joint and the ungues dark. Forceps and setæ pitch-brown or lutescent, the former with the apices; the latter at the joinings black-tinted.

♀. Very like the ♂, but with the upper half of the oculi pale olivaceous, and the under half dark sepia-brown. Pronotum jet-black. Fore femora olive-brown, the tibia and tarsus tinged with brown-ochre or lutescent, with the tips of the tarsal joints and the ungues darker. Wings paler than in the ♂; there is sometimes a spot in the midst of the hind wing.

In ill-marked examples of either sex curved lines take the places of the triangular abdominal streaks.

Length of body 14–22; wing, ♂ 16–17, ♀ 18–24; setæ, ♂ im. 33 & 34–32 & 36, subim. 16 & 17–19·5 & 21; ♀ im. 22 & 24–26 & 26, subim. 17 & 16–18 & 19.

Hab. In Europe, from Bavaria, Switzerland, and the middle of France, northwards to Lappmark; May, June, and part of July. Dr. Hagen forwarded an *Ephemera* obtained in Eastern Siberia, very similar to, if not identical with, *E. vulgata*, but having the hinder legs much lighter in colour than the normal European insect. Some specimens from Saxony and Posen (in M'Lach. Mus.) have the wings more strongly tinted, and the bordering of the cross veinlets rather broader than is customary in English examples.

EPHEMERA DANICA, Müll. Plate VIII. 12 *a* (wings, legs, forceps).

Ephemera danica, Müll., Fn. Ins. Fried. 63 (1764); id., Zool. Dan. Prodr. 142 (1776); Vill., C. Linn. Ent. iii. 18 (1789); [*Ephemera*, ! Ronald's Fly-fish. Ent. ed. i. pl. xiii. 28–29 (1836);] Walk., List of Neuropt. in Brit. Mus. 535 (1853); Hag., Ent. Ann. (1863), 15; ! Etn., Trans. Ent. Soc. Lond. (1871), 72, pl. iv. 8, 8 a [details]; Rostock, Jahresb. d. Ver. f. Naturk. Zwickau, 1877, p. 82 (1878); Meyer-Dür, Bull. Soc. Ent. Suisse, iv. 306 (1874).—*E.* ‡ *maculata*, Vill., C. Linn. Ent. iii. 22 (1789).—*E.* ‡ *vulgata*, Scop., Ent. Carn. 263 (1763); Don., Nat. Hist. Brit. Ins. iv. 53, pl. cxxviii. (1795); Sam., Ent. Comp. 260, pl. vii. 2 (1819); Wood, Ill. Linn. Gen. Ins. ii. 21–23, pl. xlvii. (1821); Duméril, Cons. Gen. s. la Cl. des Ins. 204, pl. xxviii. 4–5 (1823); Newport, Todd, Cyclop. f. Anat. & Physiol. ii. 864, fig. 345 (1839); Westw., Introd. ii. fig. 61, 1 [the abdominal spots hind before] (1840); Blanch., Hist. Nat. des Ins. iii. 53 (1840); ! Ramb., Hist. Nat. des Ins. Névropt. 293 (1842); Pict., Hist. Nat. Névropt. ii. Ephém. 126, pls. i.–vi. (1843–5); Blanch., Cuv. Règ. An., éd. Crochard, xiii. 91, xiv. pl. cii. 1–1 c (1848); Ronald's Fly-fish. Ent. ed. v. no. 28, pl. xiii. (1856); Brauer, Neuropt. Austr. 25 (1857); Gerstäcker, Handb. d. Zool. ii. 59 (1863); E. Pict., Névropt. d'Esp. 22 (1865); Oulianine, Neuropt. & Orthopt. of Prov. of Moscow, 25 (1867); Ausser., Ann. d. Soc. Natur. Modena, An. iv. 131 (1869); Meyer-Dür, Bull. Soc. Ent. Suisse, iv. 306 (1874); Joly, Rev. d. Sc. Nat. Montpellier, v. pl. vi. 1 [after Pict.] (1876).—*E. cognata*, ! Steph.,

Ill. Brit. Ent. vi. 56 (1835); Curt., Brit. Ent. xv. no. & pl. 708 (1838). *E. hispanica*, ! Ramb., Hist. Nat. d. Ins. Névropt. 294 (1842); Walk., List of Neuropt. Ins. in Brit. Mus. 535 (1853); E. Pict., Névropt. d'Esp. 23 (1865).

Subimago (*living*).—Wings at first yellowish green or greenish grey, becoming greyer, very narrowly edged with grey-black along the extreme terminal margin, the discal spots and, in the fore wings, most of the cross veinlets black, the rest of the neuration concolorous with the wing-membrane, or yellowish green. Head in ♀ dull pale ochreous tinged with green, the vertex somewhat lutescent, and between the ocelli blackened or pitch-brown; oculi deep sepia-brown. Notum at first blackened, with lutescent markings; the pronotum grey-black, tinged with greenish along the middle, and with a large similarly coloured pale blotch on each side; mesonotum lutescent, with a mitriform blotch in front bisected longitudinally by a fine line, from whose base on each side a curved black streak recedes inside the wing to the hind border of the segment, gradually expanding towards its termination, where it is flanked inside by an acutely triangular spot; tegulæ pale yellowish green; metanotum grey-black with pale sutures. Setæ black.

Imago (*living*).—♂. Head and thorax above deep blue-black, polished; the pronotum at the edges, and the joining of the head and thorax, also a fine line on each side of the mesonotum in advance of the tegulæ very pale ochraceous; oculi deep sepia-brown above, brown-black beneath; third joint and awn of antennæ black-brown; face and prosternum pale greenish yellow. Abdomen with the foremost four or five dorsal segments ivory-white, with a pale cinereous broad triangular blotch at their base on each side, pointing backwards; the hinder segments varied with pitch-brown or very deep brown-ochre instead of with cinereous, their markings sometimes confluent (leaving in the middle an ivory-white triangle upon the hind margin of the segment pointing forwards), sometimes differentiated into an abbreviated thin streak on each side of the dorsal vessel at the base of the segment, flanked by a longer and broader tapering streak which falls short of the hind margin of the segment and does not extend to the side. The larger of these streaks are represented sometimes by triangular spots in some of the more forward segments; last segment altogether dark above. The spiracular region is edged with an irregular dark line above, and an abbreviated line from the base below, in every segment. Venter somewhat tinged with brown-ochre, especially in the hinder segments, and marked in segments 2–8 or 9 with a pair of subparallel linear brown-black streaks, some of which are slightly connivent in front and abruptly pointed behind. Wings faintly grey-tinted, most distinctly so towards the anterior and terminal margins and in contiguity with their black neuration; the spots pitch-brown, placed somewhat as in *E. vulgata*, but less strongly marked. Legs pitch-black, the hinder pairs tinged with olivaceous, and with their joinings darkened. Forceps intense sepia-brown. Setæ black.

♀ very like the ♂, but with the dorsal markings of the pale ochraceous abdomen better defined. Fore legs with piceous femora, and olive-grey tibiæ and tarsi; the tibiæ at both extremities, and the apices of the tarsal joints darkened; hind legs olive-grey, the coxa, trochanter, ungues, and tarsal joinings, the base and extreme tip of the tibia,

and a spot at the tip of the femur black. Setæ brownish black, darkened at the tips of the joints. Wing-membrane colourless; hence the narrow grey bordering of the cross veinlets is better shown than in the ♂; spots grey. Length of body, ♂ 16–17, ♀ 16–23; wing, ♂ 16–17, ♀ 14–22; setæ, ♂ 35 & 30–41 & 36, ♀ im. 14–25, subim. 17 mm.

Hab. From Madrid (*Rbr.*), France, Switzerland, and Bavaria, northwards to Lapland (*Pict.*). This species usually inhabits colder and swifter waters than *E. vulgata*, and is the Mayfly of anglers. The ♀ subim. and ♂ subim. are respectively designated by them "Green Drake" and "Bastard Drake."

Ephemera lineata, Etn.

Ephemera ‡ *danica*, Pict., Hist. Nat. Névropt. ii. Ephém. 130, pl. vii. (1843 5); Oulianine, Neuropt. & Orthopt. of the Prov. of Moscow, 26 (1867).—? *E.* ‡ *vulgata*, part, Blanch., Métamorph. &c. des Ins. 127 (1868) [nec p. 594, pl.].—*E. lineata*, ! Etn., Trans. Ent. Soc. London (1870), 1; id., op. cit. (1871), 71, pl. iv. 7–7 b [details]; Hag., op. cit. (1873), 393; Meyer-Dür, Bull. Soc. Ent. Suisse, iv. 306 (1874).

Subimago (*living*).—Wings greenish grey, broadly tinged with light grey along the terminal margins; cross veinlets black, some of them in the midst of the fore wing bordered with black-brown so as to give rise to a series of spots.

Imago (*living*).—♂. Eyes dark sepia-brown above. Thorax pitch-brown above. Abdomen above in the anterior segments greenish grey modified with bistre-brown, but in the hinder segments becoming lutescent; the segments marked with longitudinal curved or slightly sinuous black streaks tapering at the ends, the anterior segments having each two long streaks on each side of the middle of the back, and the posterior segments two short lines from the base between the two pairs of streaks; venter bilineated lengthwise with black. Forceps lutescent. Setæ fuscous with black joinings. Fore legs with the femur piceous, the tibia and tarsus black: hinder legs greenish grey; the coxa, a spot on each side of the end of the femur, the tip and the joinings of the tarsus black. Wings vitreous, the fore wing in the marginal and submarginal areas, and broadly along the terminal margin tinted with blackish grey.

♀. Head yellowish ochreous, about the ocelli brown-ochreous, the eyes intermediate in colour between bistre and sepia-brown. Pronotum greenish grey, with a black longitudinal stripe on each side; meso- and metanotum brown-ochreous, with two dark longitudinal streaks between the wings. Fore legs warm sepia-brown, the end of the femur, both extremities of the tibia, and the terminations of the tarsal joints black. Wings vitreous, the anterior tinged in the marginal and submarginal areas with greenish grey; longitudinal nervures greenish grey, cross veinlets black. Length of body, ♂ 15–20, ♀ 21–25; wing, ♂ 16, ♀ 20–21; setæ, ♂ im. 30 & 35–36; ♀ im. 24 & 26 to 25 & 24, subim. 15 mm.

Hab. England, near Reading, on the Thames and Holybrook; France, near Paris; Switzerland, at Genthod, near Geneva. June and July. Dr. Hagen has sent me the two ♀ specimens cited as English examples of *E. glaucops* in his 'British Synopsis (1863). My conjecture in 1871 that they were in reality *E. lineata* was correct.

EPHEMERA GLAUCOPS, Pict. Plate VIII. (*d* head ♂).

Ephemera ‡*lutea*, Sulz., Abgek. Gesch. d. Ins. 171, pl. xxiv. 6 (1776); Röm., Gen. Ins. Lin. & Fab. Icon. Illust. pl. xxiv. 6 [after Sulz.], Explic. 23 (1789); Burm., Handb. d. Ent. Bd. ii. Abth. ii. 804 (1839); ! Ramb., Hist. Nat. des Ins. Névropt. 294 (1842).—*E. glaucops*, ! Pict., Hist. Nat. Névropt. ii. Ephém. 132, pl. viii. 1–3 (1843–5); Walk., List of Neuropt. Ins. in Brit. Mus. 536 (1853); Brau., Neur. Austr. 25 (1857); Hag., Ent. Ann. (1863), 16; Karsch, Die Insectenwelt, v. 400 (1863); Meyer-Dür, Mitth. schw. ent. Gesch. i. 221 (1864); Oulianine, Neuropt. & Orthopt. of the Prov. of Moscow, 26 (1867); Ausser., Ann. d. Soc. Natur. Modena, Ann. iv. 132 (1869); ! Etn., Trans. Ent. Soc. London (1871), 73, pl. iv. 9 (details); Hag. & Etn., *op. cit.* (1873), 393; Meyer-Dür, Bull. Soc. Ent. Suisse, iv. 306 (1874); Rostock, Jahresb. d. Ver. f. Naturk. Zwickau, 1877, 82 (1878).

Subimago (*living*).—Wings very light warm sepia-grey, the cross veinlets black, edged with darker warm sepia-grey, their edging forming spots in the usual places about the middle and near the base of the wing, the terminal borders of the wings broadly margined with light grey or warm-sepia. Eyes cæsious, or extremely light verdigris or blue verditer.

Imago (*living*).— ♂. Eyes above either light brownish-olivaceous or rusty yellowish, beneath either dark brownish-olivaceous or rusty purple-madder; face light yellowish.—(*Dried.*) Thorax above polished light reddish brown, the pronotum on each side slightly fuscescent (with a black streak there during life). Abdomen very light brownish ochre above, lighter beneath and marked with black; the dorsal markings are in segments 2–6 a single grey or black spot or longitudinal streak on each side of the segment about midway between the dorsal vessel and the lateral margin, gradually lengthening in the more hindward segments, and originating near the base of each segment, but terminating at some distance from the hinder border; in segments 7–9 two such curved linear streaks placed close together on each side in a corresponding position; in segment 10 a similarly placed black spot on each side; also in every segment but the last a black spot on each side at the base upon the prominent lateral joining, followed in segments 4–5 by a curved line, but in segments 6–7 by a fine slightly sinuous longitudinal black line, and in segments 8–9 a fine straight line situated a little higher up the side towards the hinder margin; ventral markings variable, consisting in well-marked specimens of a single discontinuous longitudinal series of linear stripes on each side of the middle tract, dilated a little at both ends in segments 4–7; but sometimes the stripes are interrupted in every segment between these dilatations, so as to leave a streak pointing backwards near the base, and another pointing forwards near the distal border, or (in some of the anterior segments) only small spots instead of streaks; and sometimes the hinder of these streaks or spots is obsolete in every segment. Setæ light rusty brown with dark-brown joinings. Forceps partly concolorous with the abdomen, and either black or piceous at the joinings only, or else with the basal and last two joints dark brown. Wings transparent, with rufescent or light Mars-yellow longitudinal nervures, and black cross veinlets, the former in transmitted light becoming rufous-amber colour; in the fore wing the submarginal area, the pterostigmatic portion of the marginal area, the narrow edging of most of the cross veinlets in front of the anal nervure (8), and the usual spots are very light raw-umber, and an almost imperceptible cloud of the same colour lies along the terminal margin; in the hind wing the corresponding bordering of the terminal margin is slightly darker

(during life it is light sepia-grey); the base of the subcosta and the anterior extremities of the cross veinlets anastomosing with it from behind are dark brown; the other cross veinlets posterior to the radius (3) are bordered with light raw-umber, but their bordering hardly gives rise to spots; in certain lights the colour described as raw-umber changes in both wings to light pitch-brown. Fore legs in opaque view dull obscure brownish ochreous, or sometimes rather redder, the tarsus darker and duller, the tip of the femur, both ends of the tibia, and the tips of the tarsal joints dull blackish; hinder legs testaceous, or dull light yellowish, the tarsi tinged somewhat with warm-sepia.

♀ similar, but the wings more faintly marked, the pronotum light bistre-grey, the abdomen of a very pale yellowish green-grey ground-colour, and the fore tarsus concolorous with the tibia. Length of body 11–17; wing, ♂ 10–15, ♀ 10–16; setæ, ♂ 15–23, subim. 17, ♀ im. 11–14 mm.

Hab. Extensively distributed on the continent; southern Sweden, Moscow, Germany, Switzerland, N. Italy; France, Paris district (M'Lach.), Toulouse; Algarve, Saõ Marcos da Serra (Etn.); and Algeria (M'Lach.). It inhabits lakes and gentle rivers. At Geneva and Lucerne the subimago abounds at street-lamps in favourable situations; and spiders lie in wait for them on the neighbouring walls in considerable numbers. Some nymphs of this species in Dr. Joly's collection were labelled *E. vulgata*, and therefore it is very possible that *E. glaucops* was the subject of both his and M. Vayssière's anatomical studies, and not the one quoted.

EPHEMERA COMPAR, Hag. Plate LXIII. 12 *e* (forceps).

Ephemera compar, ! Hag., Ann. Rep. U. S. Geol. & Geograph. Survey of the Territ. 1873, part iii. Zool. 578 (1875).

Imago (dried), ♂.—Brown-ochreous, marked with black and rufo-piceous. Head pitch-black, antennæ somewhat ochraceous. Pronotum striped on each side lengthwise with pitch-black: the stripes lanceolate, broadest behind; mesonotum light rufo-piceous with a light translucent brown-ochreous stripe down the middle; tegulæ of a light ground-colour, the notum marked in front of them with an abbreviated wedge-shaped pitch-black streak on each side. Dorsal abdominal markings:—in segments 3–8, on both sides of the disk, a pair of longitudinal subparallel black linear stripes, gently curved outwards, and every stripe at its proximal extremity slightly enlarged on the inner side; between these stripes, in segs. 6–8, is interposed a single pair of divergent black streaks from the base, longest in the hindermost; in seg. 9 the corresponding markings are confluent across the back; in seg. 2 the stripes on each side coalesce with one another and so form two quadrangular blotches; in seg. 1 the corresponding spots are small and indistinct; seg. 10 is pale (of the ground-colour) with a triangular greyish cloud on each side behind in place of the stripes; every segment has an abbreviated black streak from the base at the side close to the spiracular line, and segs. 5–7 have another from the tip; the joinings of the segments in some lights are opaque. Ventral abdominal markings:—in segs. 2–8 a longitudinal black line on each side of the middle, slightly curved inwards; in seg. 9, a quadrangular black blotch in the midst of the disk, narrowed somewhat anteriorly; in seg. 10 a large rounded black spot on each side at the base. Setæ

light fuscescent, the joinings subopaque. Forceps brown-ochreous. Trochanters each with a small black dot outside; fore femur rufo-piceous, greyish towards the base above; fore tibia and tarsus piceous; hinder femora somewhat brown-ochreous, the tibiæ and tarsi lighter, the ungues fuscescent. Wings transparent, tinted with very light dull yellowish; fore wing with the costa, subcosta, and radius rufo-piceous, the other longitudinal nervures light yellowish, the cross veinlets black; the pterostigmatic portion of the submarginal area, and the adjacent (outer) half of the corresponding part of the marginal area, together with the extreme apex of the third area from the costa, burnt-umber brown; the same colour occupies the basal portion of the submarginal area to a little beyond the great cross vein, and extends onwards from thence for some distance along the subcosta and radius, and more or less distinctly borders the cross veinlets, besides giving rise to the usual spotting of the wing; the spots are small and distinct. Hind wings with the longitudinal nervures pale yellowish excepting the subcosta towards the base, which is fuscescent; cross veinlets mostly black, several of them faintly bordered with burnt-umber grey, and a few marked with minute burnt-umber brown spots; the outer margin broadly edged with brownish grey. Length of wing 15 mm.

Hab. Foot Hills, Colorado (Lieut. W. L. Carpenter), in Mus. Comp. Zool. Cambridge, Mass.

Ephemera guttulata, Pict. Plate LXIII. 12*f* (forceps).

Ephemera guttulata, Pict., Hist. Nat. Névropt. ii. Ephém. 135, pl. viii. 4 (1843–5); Walk., List of Neuropt. Ins. in Brit. Mus. 536 (1853); ! Hag., Ann. Rep. U. S. Geol. & Geograph. Survey of the Terr. 1873, part iii. Zool. 579 (1875).—*Ephemera*, sp. nov., ♀, ! Hag., Proc. Ent. Soc. Philad. ii. 177 (1863).—*E.* ‡ *myops*, var.? Etn., Trans. Ent. Soc. London (1871), 71; Hag., *op. cit.* (1873), 393.—*E.* ‡ *simulans*, ! Provancher, Nat. Canad. viii. no. ix. 265 (1876); id., Fn. Ent. d. Canad. ii. fasc. i. 81 (1877).

Imago (*dried*), ♂.—Thorax above rufo-piceous, varied with piceous, inclining towards intense bistre-brown on the pronotum. Abdomen above, in segments 1–8, spotless whitish Naples-yellow; segment 9 of the same colour, excepting along the spiracular border, where it is narrowly margined with raw-umber brown; segment 10 raw-umber brown, with a longitudinal whitish yellow stripe in the midst of each side. Venter from the tip of segments 1–8 of the same colour as the dorsum, segment 9 ditto, with a triangular spot on each side as long as the segment tinged with raw-umber brown; segment 10 raw-umber, but the thinner portions of the perinæal lobes whitish yellow. Forceps raw-umber, the second joint lighter. Setæ, in opaque view light Vandyke-brown, with blackish joinings. Fore legs lost, excepting the coxæ and trochanters, which resemble the hinder. Hinder legs, in opaque view, light yellowish, with a blackish spot at the end of the tibia, the ungues (if not the whole tarsus) light reddish brown, the trochanter light bistre-brown, and the coxa outside in front rufo-piceous. Wings imperfectly transparent, marked in opaque view with dark bistre- or pitch-brown, changing in transmitted light to light sepia-brown, the markings consisting of a broad, slightly mottled cloud extending from the anal angle to the apex of the fore wing along the terminal margin, the pterostigmatic region, broad bordering to all the cross veinlets in the rest of the fore wing anterior to the anal nervure (8), and narrower bordering to those posterior to it, as

well as to the proximal ends of the nervures from the terminal margin that join it as branches, the bordering confluent irregularly in transverse bands (in lieu of the customary spots) in addition to the median band; in the hind wing, a broad cloud tapering behind runs backwards along the terminal margin from the distal portion of the costal margin, the edging of the cross veinlets in the submarginal area is confluent near the subcosta towards the base of the wing, but tapers rapidly towards the radius (3) beyond the limits of the confluence, a narrow irregular blotch extends from about the proximal extremity of the cubitus (4) to about the second series of the cross veinlets included within its fork (doubtless an instable character), and the edging of the cross veinlets in the remaining parts of the disk constitutes numerous small spots. Neuration piceous, but lighter in a large portion of the hind wings and in part of the axillary region of the fore wings.

♀ very similar to the ♂, the thorax rather lighter; the 9th abdominal segment as well as the foregoing segments Naples-yellow, the 10th light brownish. Setæ light raw-umber grey with black joinings. Fore femur intense Vandyke-brown or piceous, blackish lengthwise through the middle; tibia and tarsus light olive-brown, the extremities of the former, and the first joint together with the distal extremities of the intermediate joints of the latter, blackish brown, the terminal joints and ungues reddish brown; hinder legs nearly as in the ♂. Wings more transparent than in the ♂, the clouds along the terminal margins obsolescent and greatly restricted; the usual median fascia of the fore wing is broad and very distinct, but the edging of the cross veinlets elsewhere does not coalesce into blotches, excepting to a very limited extent in the places of the usual spots; the branches of the anal nervure (8) are marked each with a round spot close to their anterior extremities. In the hind wing the spot at the end of the cubitus (4) is separate from that at the fork; but otherwise the wing is very like the ♂ hind wing. Length of body, ♂ 13, ♀ 18·5; wing, ♂ 13·5, ♀ 19; setæ, ♂ about 30 mm.

Hab. New York (Osten Sacken), 9th June; Quebec (Provancher), in Mus. Comp. Zool. Cambridge, Mass.

EPHEMERA SIMULANS, Walk. Plate LXIII. 12*g* (forceps).

Ephemera simulans, ! Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 536 (1853); Hag., Smithson. Miscell. Coll. (1861), Synop. Neuropt. N. Am. 38.—*E. decora*, ! Walk., List *supra cit.* part iii. 537 (1853); Walsh, Proc. Acad. Nat. Sc. Philad. (1862), 376; *id.*, Proc. Ent. Soc. Philad. ii. 177 (1863).—*E. natata*, ! Hag., Smithson. Miscell. Coll. *supra cit.* 39 [after Walker]; *id.*, Proc. Ent. Soc. Philad. ii. 177 (1863); *id.*, Trans. Ent. Soc. London (1873), 393; ! *id.*, Ann. Rep. U. S. Geol. and Geograph. Survey of the Terr. 1873, part iii. Zool. 580 (1875).—*E.* ‡ *guttulata*, ! Etn., Trans. Ent. Soc. London (1871), 69, pl. iv. 6–6*b* [details].

‡ *Palingenia natata*, ! Walk., List *supra cit.* part iii. 551 (1853).

Subimago (*dried*).—Wings translucent, dull light sepia-grey, the wing-roots and longitudinal nervures in opaque light bistre-brown, the disk and black cross veinlets marked as in the imago. Setæ pitch- or intense raw-umber brown, with opaque joinings. Tibiæ lighter than the femora and tarsi; fore femur pitch-brown, hinder femora dark bistre-brown: tarsi sometimes blackish, sometimes Vandyke-brown.

Imago (*dried*), ♂.—Thorax above deep rufo-piceous, the pronotum in some positions

marked on each side with a rather darker longitudinal stripe: in the living insect the pronotum doubtless is translucent light sepia-brown with a pitch-black stripe on each side. Abdomen discoloured when dry, dark pitch-brown with blackish markings: in specimens preserved in spirits it is light translucent bistre with opaque intense bistre-brown (? pitch-black in life) markings, viz.—a blotch of irregular form on each side of segments 1–9 reaching from the base of the segment nearly to the edge of the terminal border (resembling a quadrangular figure emarginate at the sides and summit, composed of a pair of subtriangular longitudinal streaks, curved slightly in opposite directions, standing apart back to back and united to each other by a broad band in the greater part of their length anteriorly), constituting a single series of blotches on each side of the back; also in segments 7–9, between the blotches and adjacent to the dorsal vessel, a narrow longitudinal streak on each side from the base of the segment; also in segments 1–8, on each side of the venter, a single series of discontinuous longitudinal sublinear stripes, some of them dilated a little at the tips. Setæ medium raw-umber brown with piceous joinings. Fore legs dark raw-umber or dark bistre-brown, the tarsus more translucent, the knees, end of tibia, first tarsal joint and ungues more opaque. Hinder legs, with the femur light bistre-brown, coxa and trochanter varied with pitch-brown, the tibia and tarsus lighter than the femur and perhaps rather yellower, the ungues rufo-piceous or dark burnt-umber-brown, and sometimes the terminal borders of the tarsal joints of this colour, the whole leg from the femur onwards changing in transmitted light to brownish or greyish amber: sometimes a depression outside the femur close to the extremity, and also the tip of the tibia is dark. Wings transparent, tinged at the wing-roots with intense bistre-brown, and marked elsewhere with ivory-black in opaque view, or with intense sepia in transmitted light; the hind wings usually bordered rather broadly along the terminal margin with a faint tint of light greyish: neuration uniformly piceous. The markings of the wings present considerable diversity in the size of the spots and the edging of the cross veinlets. In strongly marked examples nearly every cross veinlet in the disk of the fore wing (excepting those near the terminal margin) situated between the costa and the anal nervure (8) is dark-bordered, the bordering of many being dilated and generally somewhat guttulate in certain areas, especially in the marginal and submarginal areas, in the distal part of the next area, and occasionally in the two areas adjacent to the first accessory nervure after the pobrachial (7). In addition to the customary fascia extending from the costa to the fork of the præbrachial (6), spots of irregular shape are apt to be formed at the proximal terminations of many of the interpolated nervures, or near them, viz.—Three spots within the space bounded by the sector (3) and the cubitus (5), two of them beyond the fascia, and one in the axil of the main nervures; also three spots in the interspace between the pobrachial (7) and the anal (8) nervures, one of them at the termination of the foremost of the long interpolated nervures, another at the head of the much shorter nervure in front of that, confluent sometimes with the fascia, but often only extended forwards to the hinder branch of the præbrachial (6^1), and a third spot at the head of the other short nervures interposed between the two long interpolated nervures. In the hind wing the dark bordering of

the cross veinlets is generally narrow, but in the midst of the wing the edging of about half a dozen veinlets or more is enlarged into small spots.

Variation.—In the fore wing the fascia is virtually resolved into its component spots, the other spots are reduced in size, the bordering of the cross veinlets is much restricted and scarcely anywhere guttulate; in the hind wing the terminal margin is not bordered with the faint greyish cloud, the spots are rudimentary or reduced to two or three in the midst of the disk, and many of the cross veinlets are not dark bordered.

♀ (*dried and in spirits*).—Very similar to the ♂, but with the latero-dorsal blotches more nearly resolved into a pair of separate triangular streaks on each side of segments 3–6, the blending of those in the other segments corresponding with what is usual in the other sex. The wings are rather clearer than is customary in the ♂, especially in the pterostigmatic region, and the edging of the cross veinlets is rather less distinct. Fore legs light rufo-piceous with the femur and tip of the tibia darker; the tarsal joints lighter towards their bases. Hinder legs as in the ♂, but the tibia and tarsus slightly redder than the femur than yellower. Setæ light burnt-umber brown, with pitch-brown joinings.

Variation (probably killed before attaining maturity of colouring).—Thorax brown-ochreous: fore femur light bistre-brown, the tibia and tarsus rather lighter, but with the ungues, the tips of the intermediate and first tarsal joints and also of the tibia dark burnt-umber brown. Hinder legs in opaque view with the femur light greenish bistre-grey, and the rest lighter, changing in transmitted light to greenish amber and light yellow amber. Abdominal markings as in the ♂.

Variation.—Colour of legs, thorax, and wings, normal; but differing in the dorsal markings of the abdomen. In segments 3–6 only the upper triangular streak of every latero-dorsal blotch is present on each side, the lower is absent (perhaps owing to the ravages of *Anthrenus*): a short linear black streak is produced forwards along the spiracular margin from the posterior lateral angle of the dorsum of each of these segments. This is the variation simulating *E. vulgata* mentioned by Hagen. Length of body, ♂ 11–13, ♀ 13–15; wing, ♂ 12–14, ♀ 15–19; setæ, ♂ im. 25–32, subim. 14, ♀ im. 16, subim. 15 mm.

Hab. North America, from Akhurst, Virginia, to St. Martin's Falls, river Albany, Hudson's Bay, and from West Beach, Maine, to Saskatchewan. This species swarms yearly at Chicago, Ill., at street lamps, about the third week in July. A tube full of specimens collected at an island in Lake Erie, near the mouth of Detroit river, by Mr. Scudder, is dated 24th July.

EPHEMERA VARIA (renamed). Plate LXIII. 12 *h* (forceps).

Ephemera ‡ *decora*, ! Hag., Smithson. Miscell. Coll. (1861), Synop. Neuropt. N. Am. 38; *idem*, ! Ann. Rep. U. S. Geol. and Geograph. Survey of the Territ. 1873, part iii. Zool. 578 (1875).

Subimago (*dried*), ♂.—Wings translucent, very light grey or whitish grey, the submarginal area of the fore wing before the pterostigmatic space slightly yellowish: neuration partly light and partly dark, the longitudinal nervures of the fore wing to a great

extent in the disk, and the whole of the neuration in the vicinage of the terminal and inner margins, light yellowish, but the subcosta and parts of the other nervures adjacent to spots, as well as the cross veinlets in the disk are black; these cross veinlets also are bordered with black-grey, and the bordering is enlarged here and there into spots as in the imago. Neuration of the hind wing mainly light yellowish, but a few cross veinlets in the basal $\frac{1}{3}$ of the disk are blackish, though not bordered.

Imago (*dried*), ♂.—Thorax above light reddish brown, approaching brown-ochreous, with a longitudinal pitch-brown stripe on each side of the pronotum. Abdomen above largely suffused with violet-grey, leaving at the sides of the segments a narrowly limited space of a light yellowish colour; the usual dorsal streaks are situated within the violet-grey spaces; their pattern, best seen in segments 6–9, comprises,—a pair of longitudinal linear streaks, one on each side of the dorsal vessel, approximated to each other at the base and blended together posteriorly; also a large triangular spot as long as the segment on each side, close to the streak and tapering distally, from whose hypotenuse in segments 5–7 a curved streak is prolonged obliquely backwards and downwards; in addition, the spiracular border of the dorsum in segments 8–9 is narrowly blackish throughout, but in the preceding segments it is blackish only for a short distance from the anterior angle apart from the terminations of the curved streaks described above. Venter very light translucent yellowish, shading into light yellow-ochraceous in the hinder segments and brown-ochre at the base of the forceps, marked lengthwise with three interrupted narrow pitch-black streaks,—one along the ganglionic track, and another on each side of it almost exactly intermediate between that and the spiracular border, posteriorly dilated in segment 9. Setæ light bistre-, or raw-umber grey with pitch-black joinings. In opaque view, the fore coxa and trochanter are light yellowish, the femur light bistre-brown, the tibia and tarsus much lighter, but with both extremities of the tibia, the first tarsal joint, the base of the second and the extremities of the other joints as well as the ungues pitch-black; the hinder femora are very light-yellowish, the tibiæ and tarsi yellowish white, and the ungues light brownish; in transmitted light the fore legs are rich brownish-yellow amber, marked with pitch-brown in the places enumerated above, and the hind legs have the femur very light yellow amber, the tibia and tarsus whitish. Wings transparent; the hind wings, and the fore wings in the immediate vicinage of the inner margin colourless, these anteriorly becoming gradually tinted more and more with light raw-umber, this tint attaining its greatest depth in the pterostigmatic portion of the marginal area and the whole of the submarginal area. Longitudinal nervures and the great cross vein from the costa to the subcosta, in opaque view, light raw-umber or light bistre-brown, changing with light transmitted to brownish-yellow amber, or golden brown; cross veinlets, great cross vein from the subcosta to the radius, and the anterior curves of the branches of the anal (8) nervure of the fore wing black, the veinlets in general edged more or less faintly and narrowly with greyish or with dark bistre-brown, many of those in the disk anterior to the anal nervure having the edging dilated roundly, and others (more broadly margined) establishing through the confluence of their bordering a dark bistre-brown band and spots in the usual situations, viz.:—a transverse curved or angulated stripe from the costa to the

fork of the præbrachial (6) nervure; a spot more distant from the wing-roots, beyond the termination of the stripe, outside that fork; and a spot nearer the wing-roots, placed at the proximal extremities of the accessory nervures interjacent between the pobrachial (7) and anal (8) nervures.

♀ (*dried*).—Meso- and metanotum light brown-ochreous; pronotum lighter, marked on each side with a broad longitudinal pitch-black stripe, which is preceded by a quadrangular spot on the cervical membrane, and is narrowly incurrent along the hinder edge of the segment; below the peak of the metanotum the prominent border is dark. Abdominal markings seemingly similar to those of the ♂, but largely effaced by Psocidæ in the specimens examined. Setæ greenish grey, with pitch-black joinings. Fore coxa and trochanter light yellow-ochreous; femur and tibia very light bistre- or raw-umber grey, blackened distally; tarsus nearly concolorous with the tibia, but duller; a small triangular spot at the outer extremity of the coxa, both ends of the tibia, the first tarsal joint and the extreme base of the second, pitch-black; the apical borders of the other intermediate joints, the terminal joint and the ungues, light burnt-umber brown. Hinder legs coloured as in the ♂. Wings transparent, colourless generally, but in the submarginal area of the fore wing tinged very faintly with greenish yellow; the spots, less blended than in the ♂, are greyish black, and the lighter edging of the cross veinlets is more restricted; wing-roots and near ends of longitudinal nervures light yellowish; the costa, subcosta, and radius external to the great cross vein of the fore wing light brownish- or greenish grey, changing in transmitted light to amber-brown; cross veinlets, and the great cross vein from the subcosta to the radius of the fore wing, black; neuration of hind wings uniformly light yellowish, membrane colourless. Length of body, ♂ 11, ♀ 15; wing, ♂ 12, ♀ 14; setæ, ♂ 25–27 mm.

Hab. New England; Norway, Maine; New Haven, Conn. (Mus. Comp. Zool., Cambridge, Mass.).

Ephemera flaveola, Walsh.

Ephemera flaveola, Walsh, Proc. Acad. Nat. Sc. Philad. (1862), 377; Hag., Proc. Ent. Soc. Philad. ii. 178 (1863); Etn., Trans. Ent. Soc. London (1871), 70.

Subimago.—Wings subopaque, the membrane slightly dusky, and, in a single ♂, with slightly dusky neuration. Setæ dull pale greenish.

Imago, ♂.—Head ferruginous above, the orbits of the ocelli and basal joints of the antennæ a little dusky. Thorax pale ferruginous. Abdomen yellowish, joints 3–7 with a lateral pale fuscous vitta interrupted at the sutures; setæ whitish with fuscous joinings. Legs yellowish; the terminal half of the fore femur ferruginous, the fore tibia and first tarsal joint, the other joints at the joinings and the last joint at the tip, fuscous; the tips of the hinder tarsi fuscous. Wings hyaline, the fore wing slightly yellowish along the costa, the neuration colourless, excepting the costa, subcosta, radius, and great cross vein, which are yellowish.

♀ similar to the ♂, but having the abdomen egg-yellow in the parts full of eggs, and having fuscous cross veinlets in the wings, excepting in the tips and along the terminal borders. Length of body, ♂ 7·5–9·5, ♀ 9–10·5; exp. of wing, ♂ 17–19, ♀ 19–

20; setæ, ♂ im. 20 & 14, subim. 9–12, ♀ im. 12 & 10, subim. 12 mm. (after Walsh).

Hab. Rock Island, Ill. (Walsh). A fragment of a ♀ subim. apparently of this species is in Mr. M'Lachlan's collection.

Ephemera myops, Walsh.

Ephemera myops, Walsh, Proc. Ent. Soc. Philad. ii. 207, note 20 (1863); Etn., Trans. Ent. Soc. London (1871), 71.

This species was described by Mr. Walsh from two ♂ examples, one of them reared from the subimago, which differed in colour from one another. The description is diagnostic only. Eyes smaller and wider apart than in *E. flaveola*; abdomen either yellowish throughout, or in segments 1–5 ferruginous, in segment 6 and segment 9 paler, and in segments 7 and 8 yellowish. Length of body 12–13; exp. of wings 26–27; setæ 27 & 19–29 & 21 mm.

Hab. Rock Island, Ill. (Walsh).

Ephemera immaculata, Etn.

Ephemera immaculata, ! Etn., Trans. Ent. Soc. London (1871), 74. pl. iv. 10 [detail].

Imago (*dried*), ♂.—Thorax brunneo-luteous above. Abdomen fuscous, the tips of the segments and the spiracular lines darker. Setæ light bistre-brown. Wings spotless, vitreous; the fore wing in the submarginal area, and the hind wing at the terminal margin tinged with sepia-grey; neuration dark. Fore legs piceous, the bases of the femora lighter; hinder legs brunneo-testaceous. Length of body, ♂, 10·5, wing 11 mm.

Hab. Cuna, Hindostan (Hope Mus., Oxford).

Ephemera expectans, Walk.

‡*Potamanthus expectans,* ! Walk., Trans. Ent. Soc. London, N. S. v. 198 (1860).

Ephemera expectans, ! Etn., Trans. Ent. Soc. London (1871), 74.

Subimago (*dried*).—Fore wings very pale raw-sienna, with dull light brown-ochreous longitudinal neuration, and intense violet-carmine (approaching black-purple) cross veinlets; hind wings rather greyer, with black-purple cross veinlets. Setæ raw-umber grey, with pitch-black joinings. Thorax brown-ochreous above, with a broad pitch-brown stripe on each side of the pronotum, followed by a line on each side of the mesonotum, extending to the area above the wing-roots. Abdomen (discoloured) dark orange-brown, with four slender longitudinal black lines in segments 2–8, and two lines along the venter. Fore legs dark brown-ochreous, the termination of the tibia pitch-black, the distal edges of the nearer tarsal joints and the whole of the terminal joint and ungues pitch-brown; hinder legs lighter, with the broader ungues pitch-brown. Length of body, ♀ 11, wing 14 mm.

Hab. Hindostan (Walker, in Brit. Mus.).

Ephemera supposita (renamed). Plate VIII. 12 *c* (forceps).

‡ *Potamanthus fasciatus,* ! Hag., Verh. zool.-bot. Gesells. Wien, viii. 476 (1858) [part].

Ephemera fasciata, ! Etn., Trans. Ent. Soc. London (1871), 74, pl. iv. 11, 11 *a* [details]; idem, *op. cit.* (1873), 393.

Subimago (*dried*), ♀.—Wings fawn-colour, the stronger of the longitudinal nervures yellowish, the cross veinlets of the fore wings black; the submarginal area of the fore wings is tinged with yellowish, and some of the cross veinlets in the marginal area are edged with darker towards the subcosta.

Imago (*dried*).—Thorax testaceous above. Abdomen eroded by Psocidæ, but it appears to have been light bistre-brown on the dorsum, with two darker streaks projecting forwards on each side from the darker hinder borders of segments 1–9, subparallel with each other in segments 9–7, but curved slightly away from each other towards their anterior extremities in the other segments; also in at least segments 9–7 the dorsal vessel appears as a black line; on the venter are visible traces of the usual two longitudinal series of discontinuous linear black stripes. Setæ medium Mars-yellow, with many of the joinings reddish brown. Forceps dull yellowish, with the terminal two joints black. Wings transparent, slightly tinted with greyish, with reddish brown longitudinal nervures and piceous cross veinlets; the fore wing in the submarginal area, and the pterostigmatic portion of the marginal area, tinged with madder-brown, and having small spots of a similar colour in the usual places in the midst of the wing—one at the fork of the præbrachial nervure (6), one close to it on the cubitus (5), another on the first sector (4), and a dot more distant from the wing-roots than these on the pobrachial nervure (7); hind wings similar in the colours of their neuration, but spotless, and rather faintly clouded very narrowly with reddish grey along the terminal margin. Fore tibia madder-brown, the tarsus rather obscurer, the femur somewhat rufescent; hinder legs light yellow-amber, the tarsus more opaque with red-brown ungues. Length of body, ♂, 13, wing 11, setæ about 21 & 23 mm.

Hab. Ceylon (Hag. & M'Lach. Mus.). The ♀ im. from Masuri, northern India, mentioned by me in 1871, is very similar in the pattern of its markings, but perhaps is another species.

EPHEMERA SERICA, Etn.

Ephemera serica, ! Etn., Trans. Ent. Soc. London (1871), 75, pl. iv. 12, 12 a [details].

Subimago (*dried*), ♀.—Wings very light yellowish grey, with dull light yellowish neuration; in the fore wing most of the cross veinlets between the costa and the sector, and many of those posterior to this last nervure in the proximal third of the disk of the wing are black, a few are also bordered with black, and in the area posterior to the submarginal area 3–5 cross veinlets beyond the bulla are marked each in the middle with a round black spot.

Imago (*dried*), ♂.—Head light brown-ochreous, reddish brown in the vicinage of the ocelli. Thorax brown-ochreous, with an elongated black spot on each side of the pronotum. Abdomen pale yellow-ochreous, marked with black lines, shown best in the ♀ examples. Setæ ochraceous, the two outer annulated irregularly with black. Wings vitreous, the fore wing with the neuration in a larger measure golden brown, but with the cross veinlets in advance of the sector, and those behind it in the basal $\frac{1}{3}$ of the disk pitch-black, some of them spotted with warm-sepia-brown in correspondence with the markings of the subimago; hind wings spotless. Fore femur deep raw-umber brown,

pitch-black at the knee; fore tibia and tarsus light brown-ochre, the femur pitch-black at both extremities; fore coxa and hinder legs very light yellow-ochraceous, all with a black spot on the coxa.

♀ (*dried*).—Very like the male; the pronotal spots smaller, the wing-spots very indistinct, almost effaced. Abdomen above in segments 3–9 marked with a pair of subparallel fine black lines along the middle of the back, interrupted only at the overlapping apical borders of the segments, also with an abbreviated black line on each side along the spiracular border from the posterior angle of the dorsum extending to half the length of the segment, and perhaps with the hinder border of the dorsum black in the middle; venter in segments 3–7 marked along the middle with two slightly sinuous black lines, and with a greatly abbreviated longitudinal black line from the base on each side at the spiracular border. Legs very light yellow-ochraceous; the fore femur slightly darker; its tip, both extremities of the fore tibia, and the proximal joint of the fore tarsus pitch-black; the flat claw blackish in every tarsus. Length of body, ♂ 11, ♀ 14; wing, ♂ 13, ♀ 18; setæ, ♀ subim. 17 mm.

Hab. China, Hongkong (Brit. Mus.). The subimago in the Museum has no spots on the pronotum.

Ephemera orientalis, McLach.

Ephemera orientalis, ! McLach., Trans. Ent. Soc. London (1875), 168.

Imago (*dried*; *after McLachlan*), ♂.—Body pale greyish yellow, with a black longitudinal streak on each side of the mesonotum, and some blackish markings on the abdomen, viz.—with the posterior borders of the dorsal segments narrowly blackish, also, in segments 4–8, with a black line from the base of each segment extending some distance along the course of the dorsal vessel and flanked on each side of the dorsum with a pair of slightly curved black linear streaks; venter marked in the intermediate segments with a longitudinal straight black line on each side. Setæ at the base universally yellowish, afterwards narrowly blackish at the joinings. Forceps rather short, their last two joints short. Legs pale yellow; the tibiæ and tarsi of the fore legs fuscous. Wings vitreous, with a faint yellowish tint, the hinder spotless, and along the terminal margin rather broadly bordered with pale greyish; neuration blackish, the cross veinlets of the marginal area incrassate and deep black, the bullæ black, and the cross veinlets adjacent to that of the subcosta distinctly bordered with black. Length of wing 15 mm.

Hab. Japan; Von Siebold (Leyden Mus.).

Ephemera japonica, McLach.

Ephemera japonica, ! McLach., Trans. Ent. Soc. London (1875), 169.

Subimago (*dried*), ♀.—Wings transparent light greenish grey, spotless in one example, the submarginal area of the fore wing clear yellowish green, the terminal margin of the hind wing narrowly edged with greyish, that of the fore wing hardly perceptibly so; neuration mostly pitch-black, but just at the wing-roots brown-ochreous. Setæ deep sepia-brown at the base, becoming lighter distally, the joinings not conspicuously darker.

Imago (*dried*), ♂.—Head above very light Mars-yellow ochreous, in ♀ pitch-brown. Pronotum light raw-umber brown, with a linear pitch-brown longitudinal stripe on each side; the remainder of the notum in ♂ slightly yellower, in ♀ brown-ochreous, varied in the metanotum with light yellow-ochre. Abdomen above in ♂, and after oviposition in ♀, very pale translucent raw-umber, the hinder segments (7– or 8–9 or 8–10) light yellow-ochraceous, the tenth sometimes very light brown-ochre; segments 2–9, each with a pair of warm sepia-brown dorsal stripes, divergent and gradually tapering from behind forwards, descending obliquely one on each side from the hinder border to the spiracular border close to the base of the segment, and approximated to one another at the hinder border more closely in the more forward than in the hinder segments; these stripes in segments 4–8 are connected each with the other by an extension of the same colouring along the intervening portion of the hind margin; and the bands thus connecting them together are intersected in the ♂, but not in the ♀, by a fine longitudinal black line along the dorsal vessel in segments 6– or 7–9; this line in the ♀ does not attain the hinder borders of the segments. Venter rather lighter than the dorsum in segments 1–7, and thence posteriorly becoming bright brown-ochreous; a fine pitch-black streak on each side of segments 7–2, subcontinuous with the dorsal stripe of the following segment, runs from the hinder angle of the segment obliquely inwards to the anterior margin, subparallel with the immediately superjacent dorsal stripe; viewed laterally, the ventral streak of one segment in combination with the dorsal stripe of the following segment appears slightly sinuous; in segment 8 of the ♂ the corresponding ventral streaks taper at both ends, and do not reach the hinder lateral angles; those in the same segment of the ♀ meet one another close to the opening of the oviducts; in segment 9 they are subparallel with one another, almost perpendicular to the hinder border of the segment, linear in the ♀, but in the ♂ broader, deep burnt-umber brown, and sometimes ill-defined posteriorly. Setæ deep warm sepia-brown, the joinings pitch-black. Forceps light brown-ochreous, darker distally. Fore femur (as an opaque object) light reddish brown, or (in transmitted light) bistre-amber colour, the tibiæ pitch-brown, the tarsus rather lighter; hinder legs extremely light yellowish ochre with brownish ungues; the femora in transmitted light very pale yellow amber-colour. Wings vitreous, faintly tinted with light greenish yellow; submarginal area of the fore wing more strongly so tinted; terminal margin of the fore wing very narrowly and faintly, that of the hind wing more distinctly and to a moderate depth, bordered with warm sepia-grey; neuration pitch-brown, the subcosta, or subcosta and radius, of the fore wing pitch-black, the nervures becoming lighter towards the wing-roots, the bulla of the subcosta and that of the first sector, together with a minute spot, nearly in a line with them, on the cubitus of the fore wing slightly greyish. Length of body, ♀, 14–16, wing 18–19, setæ, ♀ im. 25·5, subim. 16 mm.

Hab. Yokohama (Pryer, M'Lach. Mus.).

PENTAGENIA, Walsh, 1863.

Illustrations. Adult. Pl. VIII. 13 (details).

Adult.—Pronotum in ♀ transverse, enlarged posteriorly, subtumescent above, broader

and higher than the head behind, but narrowed and sloping downwards anteriorly; its lateral borders, posteriorly, suddenly everted to a slight extent so as to originate a strongly defined sinus or rounded depression on each side of the back; its hind margin curved; in ♂ the pronotum appears to be more appressed to the mesonotum, so that in front view the hind margin seems almost retuse in the middle. Fore leg of ♂ about half as long as the body, the tibia about $1\frac{3}{5}$ as long as the femur, the tarsus scarcely as long as the femur; ♀ fore femur little shorter than the tibia, the tarsus scarcely $\frac{2}{3}$ as long as the tibia. Median setæ in ♂ extremely rudimentary, in ♀ not much shorter than the others; outer setæ in ♂ about $2\frac{1}{2}$ as long as the body, in ♀ im. and ♂ subim. subequal in length with it; under a lens their surface appears minutely pubescent throughout, and their joinings are inconspicuous. Last two joints of forceps-limbs rather small. Lobes of penis nearly straight, subtubular, and somewhat tapering distally; the orifice of the seminal duct terminal; no apparent stimuli. Abdominal segments of ♀:—1 short and thoracoid, 2–6 gradually and successively longer, 7–9 nearly equal to one another, but 8 perhaps a little the longest, and 9 a little longer than 7, which is only a little longer than 6; segments 6–10 together constitute $\frac{1}{2}$ of the abdomen. Anterior ocellus rather smaller than the others. Eyes of ♂ nearly approximated if not mutually contiguous above.

Nymph unknown.

Type. P. vittigera, Walsh.

Distribution. Illinois and Texas.

Etymology. πέντε and γενεά, from its being the fifth of the sections of *Palingenia auctorum*, defined by Hagen in 1863, and named by Walsh in that year.

Pentagenia vittigera, Walsh. Plate VIII. 13 (wings, legs, ♂ & ♀, forceps).

Palingenia vittigera, ! Walsh, Proc. Acad. Nat. Sc. Philad. (1862), 373; Hag., Proc. Ent. Soc. Philad. ii. 174 (1863).

Pentagenia [type] *vittigera*, ! Walsh, *op. cit.* ii. 197 (1863); ! Etn., Ent. Mo. Mag. v. 85 (1868); ! id., Trans. Ent. Soc. London (1871), 63, pls. i. 6 and iv. 1 [details].

Subimago.—"Wings dull opaque yellowish" (Walsh).

Imago.—Eyes of the living ♂ (*teste* Walsh) yellowish above, their lower $\frac{1}{4}$ ferruginous. (*Dried*) ♂.—Body traversed from head to tail along the middle of the back by a deep warm sepia stripe, containing in segments 1–9 of the abdomen the usual pair of short divergent yellowish lines at the base of every segment; sides and under parts of the body chiefly light yellowish ochreous or Naples-yellow, but segments 8–10 of the abdomen are of a brighter yellow beneath, and on each side of the mesothorax a warm sepia stripe descends from the roots of the fore wing obliquely. Legs, viewed opaquely, very light yellowish ochraceous, but in transmitted light of a yellowish amber-colour; fore tibia light brown-ochreous, the tarsus rather darker, the end of the tibia and the extremity of the broader of the tarsal ungues warm sepia or burnt-umber brown; hinder tarsi with the ungues and the tips of the terminal joints tinged with bistre-brown. Wing-neuration translucent, mostly colourless; in the fore wing the great cross vein between the subcosta and the radius, and a short linear spot at the bullæ of the subcosta and the

sector are pitch-black; but the costa, subcosta, and radius, together with the cross veinlets of the marginal and submarginal areas, are in opaque view bistre-grey, and in transmitted light pale golden brown, or brownish amber-colour. Setæ dull light yellowish white.

♀ (*dried*) very similar. The wings towards the base, especially in the marginal area of the fore wing, tinted with lurid.

Length of body, ♂ 17–19, ♀ 17–20; wing 18–19; setæ, ♂ 40–50 & 5, subim. 18 & 4·5, ♀ 13 & 10·5–20 & 15 mm.

Hab. Near Rock Island, Illinois, and in Texas (Walsh & M'Lach. Mus.). The part of the dorsal stripe in each segment of the abdomen is quadrangular, nearly straight at the sides, and only a little broader in front than behind.

PENTAGENIA QUADRI-PUNCTATA, Walsh.

Pentagenia quadripunctata, Walsh, Proc. Ent. Soc. Philad. ii. 198 (1863); Etn., Trans. Ent. Soc. London (1871), 64.

This species is diagnosed by Walsh as differing from *P. vittigera* in the following details. The part of the dorsal stripe in each segment of the abdomen is angulated at the sides and hexagonal in form. In the fore wing a series of four distinct fuscous dots, surrounded each by a slight cloud, is extended transversely in a slight curve from the middle of the costa to the midst of the wing (the dots presumably corresponding with bullæ), marking the subcosta and the 4th, 6th, and 9th longitudinal nervures from the costa. Wings of subimago opaque whitish. Length of body, ♂ 19, ♀ 19·5–22; wing, ♂ 15; ♀ 18–19·5; setæ, ♀ im. 22·5 & 19·5, subim. 17 & 14, ♂ subim. 15 & 3 mm.

Hab. Rock Island, Illinois.

PART II. Read February 7th, 1884.

GROUP II. OF THE GENERA.

Adult.—At the fore-wing roots the anal nervure (8) communicates with the pobrachial (7) only by means of an obsolete channel of circulation permeating the membrane in proximity to the prominent curved or angulated fold that meets the basis of the radius (3) [excepting perhaps in *Tricorythus* and *Cœnis* (Pl. XV. 25 and 26). *N.B.* In Pl. IX. the figure of part of the wing of *Rhoënanthus*, 15, is defective thereabouts]. Legs all functional; hinder tarsi with 4 distinct joints, and sometimes with colour-indications of a fifth joint intimately concrete with the tibia (*i. e.* not definitely limited by suture); ungues rather small. Contour of ♂ oculi various in different sections. *Nymph.*—Palpi of both pairs of maxillæ 3-jointed. [Exceptions: palpus of maxilla I. 4-jointed in *Prosopistoma*, 2-jointed in *Callibætis*; palpus of maxilla II. with joint 3 ill defined in *Baëtis.*]

First Series of Group II.

Adult.—The anal (8) and bifid 2nd axillary nervures, together with the inner margin of the fore wing, enclose a semisagittate space; the 1st axillary nervure (9^1) connivent

with the anal at the roots, and running nearly alongside of it for some distance, presently recedes from it in a bold curve to the middle of the inner margin. Hind wings well developed, broad; the costal shoulder sharply defined, almost right-angled, and situated at about the first $\frac{1}{5}$ of the front margin; the subcosta (2) elbowed correspondingly, and approximated to the costa soon after the flexure. Thoracic spiracles straight-lipped, usually closed in dried specimens. Forceps-limbs inserted at the sides of the terminal border of a transverse laminar lobe prolonged from the segment, which lobe is represented in the ♀. Eyes of ♂ evenly contoured; anterior ocellus rather smaller than the others. *Subimago* quiescent many hours.

Section 4 of the Genera.—Type of *Potamanthus*. *Adult.*—Proximal joints of ♂ forceps-limbs many times longer than the remainder combined. *Nymph.*—Wings free along their terminal margins. Palpus of maxilla I. longer than the lacinia. Lobes of the labium smaller than the laciniæ of maxillæ II. Abdominal segments 2–7 branchiate; the gills inserted into postero-lateral prominences of the segments, and divergent backwards from the sides of the body; hinder lateral angles of the segments not prolonged. Natation laboured, aided by movements of the legs; fore legs of moderate proportions and simple construction, the femur rather shorter than the tibia.

The insects ranked in this section have strong affinity with the *Ephemeræ*. The chief differences between the flies consist in the structure of the forceps, the laminar lobe of the ♀ 9th ventral segment, and the bifurcation of the second axillary nervure of the fore wing. This last characteristic is met with in some undescribed allies of *Potamanthus*, as well as in all that have been published. The nymph has more congruity with the Leptophlebiæ; and the structure of the flies justifies their being grouped with these rather than with *Ephemera*.

POTAMANTHUS, Pict. 1843–5; restricted, Etn. 1871.

Illustrations. Adult, Pl. IX. 14 (details); (whole figures) Pict., Hist. Nat. Névropt. ii. Ephém. pl. xxv. 1–3 (1843–5). *Nymph*, Pl. XXXI. (whole figure and details); refer also to *Eucharidis*, Joly (1876), under *P. luteus*.

Adult.—Setæ 3, subequal to each other; in ♂ im. about $1\frac{1}{2}$, ♀ $1\frac{1}{3}$, and in ♂ subim. just as long as the body. Fore leg of ♂ as long as the body, the tibia $1\frac{3}{5}$ as long as the femur, and nearly as long as the tarsus; ♀ fore femur almost as long as the tibia, tarsus nearly $\frac{3}{4}$ as long as the tibia; hind tarsus about $\frac{1}{2}$ as long as the hind tibia; ungues unequal, and (excepting in ♂ fore tarsus) dissimilar. Anterior ocellus a little smaller than the others. Pronotum of ♀ transverse, produced into a flattened lobe closely appressed to the mesonotum and rounded posteriorly. Lobes of the penis flattened, without apparent stimuli. Body slender: abdominal segments of ♀ 1 and 10 short; 2–4 equal, and about twice as long as 10; 5, 6, and 9 mutually subequal, and little longer than 4; 7 and 8 mutually equal, and longer by as little than 6. Flight chiefly late in the evening and nocturnal. *Subimago* usually quiescent about twenty-four hours, standing upon its hinder legs with the fore legs mutually subparallel and horizontally prorect, the setæ close together, and the wings erect. *Nymph* latent; tracheal branchiæ all double and

uniform; their divisions subequal, plumose or pinnatisect with linear acuminate segments, and not conduplicate lengthwise. Setæ plumose, about ½ as long as the body. Outer surface of each mandible armed with a single acute spine or tubercle, not prolonged into a tusk; their innermost fang furnished with a moveable appendage [endopodite]. Lacinia of the 1st maxilla crowned with a patch of dense hair. Median lobe of the tongue obcordate. Antennæ setaceous, almost glabrous. Labrum externally strigose. Lobes of the labium very small. Pronotum oblong, nearly straight at the sides, and slightly concave at the margin in front and behind. Intermediate leg the longest.

Type. P. luteus (in *Ephemera*), Linn.

Distribution. Temperate and southern Europe; also (undescribed sp.) in the State of Virginia.

Etymology, ποταμός and ἄνθος, river-flower.

Potamanthus luteus, Linn. Plate IX. 14 (wings, legs ♂ ♀, head, penis, and forceps ♂ adult).

[*Ephemera*] or *Ephemera lutea* [Geof., Hist. Ab. Ins. Paris, ii. 238, no. 2] (1764); Linn., S. N. ed. xii. 906 (1767); Fab., Syst. Ent. 303 (1775); [? Schaef., Ic. i. pl. xlii. 7 (1776)]; Schr., En. Ins. Aust. 603 (1781); Fab., Sp. Ins. i. 383 (1782), and Mant. Ins. i. 243 (1787); Vill., C. Linn. Ent. iii. 17 (1789); Rœm., Gen. Ins. 23 (reproduced from Schaef. 1776); [Zsch., Mus. Lesk. i. 50, no. 14] (1789); Gmél., Linn. S. N. ed. xiii. p. 2628 (1790); Ros., Fn. Etr. ii. 8 (1790); Ol., Encycl. Méthod. vi. 417 (1791); Fisch., Vers. ein. Naturgesch. v. Livland, 565 (1791); Fab., Ent. Syst. emend. iii. pars i. 68 (1793); Seetzen, Meyer Mag. f. d. Thiergesch. i. 41–63 [Hag.] (1794); Schr., Fn. Boica, Heft ii. Bd. ii. 197 (1798); Walck., Fn. Paris. ii. 8 (1802); Lat., Hist. Nat. xiii. 95 (1805); Blanch., Hist. Nat. Ins. iii. 54 (1840); Duf., Mém. par div. sav. Institut. de France, viii. 580, note (1841); [Joly, Feuil. d. jeun. Nat. 1876, Mars, pl. ii. 6 (legs misdrawn)].—? *E.* ‡ *marginata*, Mül., Zool. Dan. Prod. 142 (1776).—*E. reticulata*, Fourc., Ent. Paris. ii. 350 (1785).—*E. hyalina*, Pz., Explic. Schaef. Ic. xliii. (1804).—*E. flavicans*, ! Ramb., Névropt. 296 (1842); Walk., List of Neuropt. Ins. in Brit. Mus., part iii. 536, ? var. (1853).—*E. chlorotica*, ! Ramb., Névropt. 296 (1842); Walk., *op. cit.* 540 (1853).

‡*Baetis mellea*, Curt., Phil. Mag. ser. 3 (1834), p. 121.—*B. marginalis*, Burm., Handb. Ent. Bd. ii. Abth. ii. 801 (1839).

Potamanthus luteus, Pict., Hist. Nat. ii. Ephém. Névropt. 208, pl. xxv. 2, 3 (1843–5); Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 539 (1853); Hag., Stet. ent. Zeit. xxvi. 229 (1865); Etn., Trans. Ent. Soc. London, 1871, p. 76, pl. ii. 1 (wing), and iv. 13–13*a* [details] (1871); Meyer-Dür, Bull. Soc. Ent. Suisse, iv. 317 (1874); Rostock, Jahresber. d. Ver. f. Naturk. Zwickau, 1877, p. 83 (1878); M'Lach., Ent. Mo. Mag. xv. 92 (1878).

Eucharidis Reaumuri, ! N. & E. Joly, Rev. d. Sc. Nat. Montpellier, v. 314, pls. vi. 13–15, vii. 16, and viii. 30, 31 [nymph] (1876).

Subimago (living).—Wings yellow, or in the ♀ tinged with greenish grey; the fore wings rather darker towards the costa, with black cross veinlets. Eyes of ♂ light olive-green (flavo-virens, Müller), or sometimes light grass-green (gramineus, Mül.). From head to tail a broad median brownish yellow-ochreous stripe occupies most of the dorsum; this is narrowed towards the base of every abdominal segment, and contains the usual pale pair of short divergent lines and dots in each of them: the remainder of the body is sulphur- or straw-yellow, but in the abdomen near the bases of segments 2–9, close to the spiracular line, is a black dot on each side of the dorsum, and higher up in

the hinder portion of the segment in segments 1–7 is a piceous dot on each side: the penultimate ventral segment more or less brown-ochreous. Setæ chiefly brownish yellow-ochreous, becoming whitish distally; their joinings and a tinge at their roots reddish or piceous.

Imago (*living*).—Eyes of ♂ glaucous or olive-brown above. Body marked in a manner similar to that of the subimago. Forceps stramineous, their joinings narrowly testaceous. Coxa, trochanter, and base of the femur of the fore leg straw-yellow, the rest of the femur brownish yellow-ochreous; tibia rufo-piceous at the knee, then testaceous, but at the extremity, including the pedicel of the tarsus, piceous; tarsus fumatose with piceous joinings and subrubiginose ungues. Hinder legs straw-yellow, their tarsi testaceous, with the joinings and ungues subrubiginose. Setæ sublutescent with piceous or black joinings. Wings flavescent, with fuscescent cross veinlets; these, in the pterostigmatic space of the fore wing, are numerous, sinuous, and anastomose with one another.

♀ brighter than the ♂, but otherwise very similar; the fore legs more nearly of the same colours as the hinder pairs, with their tarsal joinings dark fuscous. Length of body, ♂ 10–13, ♀ 9–13; wing, ♂ 12–13, ♀ 15; setæ, ♂ im. 18 & 15–19 & 16, subim. 13; ♀ im. 12 mm.

Hab. England, at Weybridge, Surrey (*M'Lach.*); first recorded by Curtis without locality. France, near Paris (*Geoffroy*); common near Brive (Haute Loire) at 2000 ft.; in the defile of Pierre-Lis, near Quillan (Aude) at 1100 ft.; Toulouse, at 426 ft. altitude. Switzerland, at Zurich (*M'Lach.*). Germany (*Sulz.*), Heidelberg (*Pict.*); Courland (*Brauer*), July and August. My captures at Brive and Quillan were made by beating alder trees near swift parts of the rivers in the daytime; but those at Toulouse were effected after nightfall at gas lamps in the vicinage of Pont St. Michel. The scarcity of this species in collections is probably due more to its time of flight than to its actual rarity. The nymph harbours under stones in gently flowing water at the borders of rapids.

Potamanthus Ferreri. Pict.

Potamanthus Ferreri, Pict., Hist. Nat. Névropt. ii. Ephém. 203. pl. xxv. 1 (1843–5); Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 539 (1853); Etn., Trans. Ent. Soc. London (1871), 77.

Imago (*dried*), ♂.—According to M. Pictet this species differs from *P. luteus* in having uniformly pale yellow setæ, colourless wings with very light yellow longitudinal nervures and translucent cross veinlets, and a strongly defined brown spot on the hinder part of the mesonotum, where *P. luteus* is often bright yellow. When he describes the dorsal stripe as composed of a series of trianglar spots, one in every segment but the last, there is reason for suspecting that these triangles are truncated anteriorly. Length of body 13, exp. of wings 30, setæ 18 mm.

Hab. Captured near Turin by le Chanoine Ferrero. The unique specimen formerly in the Geneva Museum, was not there in 1867.

RHOËNANTHUS, Etn. 1881.

Illustrations. *Adult* (details), Pl. IX. 15.

Adult.—Setæ 2 (the median being aborted), in ♂ twice as long as the body. Legs apparently more slender than in *Potamanthus*; fore tibia of ♂ upwards of $1\frac{3}{5}$ as long as the femur, the tarsus $\frac{4}{5}$ as long as the tibia; hind tarsus scarcely $\frac{1}{3}$ as long as the tibia. Ungues unequal and dissimilar. Very like *Potamanthus* in other respects.

Type. *Rh. speciosus*, Etn.

Distribution. Dutch East Indies.

Etymology. ῥοή and ἄνθος, in imitation of *Potamanthus*.

RHOËNANTHUS SPECIOSUS, Etn. Pl. IX. 15 (♂, wings, legs, penis, and forceps).

Rhoënanthus speciosus, ! Etn., Ent. Mo. Mag. xvii. 192 (1881).

Subimago (*dried*).—Wings whitish, tinted more or less with very light yellowish ochraceous along the inner and terminal margins; most of the cross veinlets between the costa and anal nervure (8) of the fore wing edged with blood-red.

Imago (*dried*), ♂.—Mesonotum brownish ochreous. Abdomen discoloured above, but varied with sanguineous; venter light yellow-ochreous. Setæ whitish ochreous, their joinings more or less sanguineous or atro-sanguineous; the forceps tinged with the same colour. Wings transparent; many cross veinlets of the fore wing are conspicuously bordered with sanguineous, and their bordering is irregularly confluent so as to form blotches of variable extent. Legs pale ochraceous; the fore leg at the tip of the femur, at both ends of the tibia, and at the tarsal joinings, tinged with red-purple or sanguineous; hinder legs with the distal edges of the tarsal joints very narrowly sanguineous.

♀ marked similarly, but less distinctly. Length of body, ♂ 13, ♀ 16; wing, ♂ 11–12, ♀ 16; setæ, ♀ 25 & 1–26 & 1 mm.

Hab. Lahat, Palembang, Sumatra (Mus. Soc. Zool. "Natura artis magistra" Leyden, and Mus. Comp. Zool. Cambridge, Mass.). Also Java (Leyden Mus.).

Second Series of Group II. of the Genera.

Adult.—The anal (8) and normally simple second axillar (9^2) nervures, with the inner margin of the fore wing, enclose a trilateral space somewhat leg-of-mutton-shaped [a curved trilateral, truncate at the narrow proximal end, in *Ephemerella* and *Hagenulus*]; anal nervure distinctly separate from the pobrachial (7) at the roots; first axillar (9^1) usually projected in a simple curve from the prominent basal fold, and strongly arched towards the inner margin; but sometimes at the base of the wing it is curved forwards abruptly, tending to annex itself to the extremity of the anal nervure, thus becoming in a small degree unevenly sinuous. The area intervenient between the anal (8) and first axillar (9^1) nervures is termed the "anal-axillar interspace"; it contains from 2–5 interpolated longitudinal nervures, incurrent from the margin, termed "intercalar" or "intercalary" nervures, and designated numerically in the text (but unnumbered in the Plates) in the order of their nearness to the anal nervure. Hind wings of moderate or small proportions, either gently, and on the whole continuously, curved in front, or else suddenly refracted in the middle of the fore margin; in the former case the subcosta (2)

is curved in correspondence, but in the latter it is usually almost straight, and often subparallel with the abruptly abbreviated costa. Metathoracic spiracle straight-lipped; the valves usually closed, or connivent, in dried specimens: mesothoracic spiracle larger, the aperture narrow, and sometimes furnished with a very minute guard at its anterior corner, the lips unequal, usually gaping a little in front, the uppermost strongly vaulted and (when the guard is absent) often bent round the front of the aperture. Pronotum of ♀ closely appressed to the mesonotum, longitudinally carinate, and posteriorly excised or retuse in the middle. Forceps-limbs inserted at the sides of the terminal border of a transverse, and commonly deflexible, lobe extended from the segment, termed the "forceps-basis," and represented by a projecting lamina in the ♀, termed the "ventral lobe of segment 9." Eyes of ♂ ascalaphoid; anterior ocellus rather smaller than the others. *Subimago* quiescent during many hours, standing (so far as observed in European genera) upon all of its feet, with wings erect, and with the lateral caudal setæ spreading, or divergent from the middle seta.

Section 5 *of the Genera.*—Type of *Leptophlebia*. *Adult.*—Pronotum of ♀ traversed lengthwise by a raised median line or fine ridge, and excised (or at least strongly emarginate) in the middle of its posterior border. Hind tibia usually longer than the femur, rarely subequal to it; the tarsus shorter than the tibia. First axillary nervure (9^1) in some degree convergent towards the second axillary (9^2) near the base of the fore wing [not obviously so in Pl. XII. 19, *Choroterpes*]. *Nymph* [out of nine genera in this Section four are unknown].—Wings free along their terminal margins. Palpus of 1st maxilla longer than the lacinia, which is crowned with a dense tuft of hair, and ciliate on the inner edge below the point. Lobes of the labium smaller than the laciniæ of the 2nd maxillæ. Abdominal segments 1–7 furnished with tracheal branchiæ, those of the first segment erect. Hinder lateral angles of the posterior segments slightly produced. Natation laboured, aided by movements of the legs.

To exclude the possibility of the figures of wings being supposed to afford precise characteristics of genera, suitable for employment in analytical tabulation, variations of the most obvious features of the neuration are tediously noted in the generical descriptions. The variations in every genus proceed methodically, not at random. In view of the consequent prolixity of the descriptive text, the following aid to the determination of genera may be referred to with advantage when adult specimens require assorting.

Analysis of Genera of the *Leptophlebia* Type:—

Hind wing in front somewhat
- arcuate; tarsal claws all narrow and hooked ..... *Atalophlebia.*
- depressed in the middle; each tarsal claw unlike the other; median caudal seta
  - subequal to the others ..... *Leptophlebia.*
  - far shorter than the others ..... *Blasturus.*
- strongly angulated; tarsal claws
  - all narrow and hooked; basal joint of forceps-limb longer than the remainder *Adenophlebia.*

each unlike the other; basal joint of forceps-limb
longer than the remainder; egg-valve
strongly developed; ♀ ventral lobe of segment 9 bifid and excised . *Hagenulus.*
absent; ♀ ventral lobe of segment 9
obtuse or slightly emarginate; of the intercalaries in the anal-axillar interspace of the fore wing, the nearest to the anal out of 4 or 5 is long..... *Thraulus.*
bifid and acutely excised; of the intercalaries quoted, the nearest out of 4 to the anal nervure is short..... *Calliarcys.*
about as long as the remainder; egg-valve absent; ♀ ventral lobe of segment 9 bifid and excised; of the intercalaries quoted, the nearest to the anal out of 3, 4, or 5 is short ..... *Habrophlebia.*
very short; joint 2 longer than the remainder; ♀ ventral lobe of segment 9 obtuse ..... *Choroterpes.*

ATALOPHLEBIA, Etn. 1881.

Illustrations. Adult (details), Pl. X. 16 *a*–16 *h*; (whole figures) see citation of Pictet under *A. australasica*. [*N.B.* A median seta is commonly present.]

Adult.—Hind wing in front somewhat arched, the summit of the arch obtusely subangular, situated usually before the middle of the curve; subcosta (2) strongly arched, meeting the margin very obliquely; radius (3) usually nearly straight, constituting as it were the chord of the arch described jointly by the subcosta and the portion of the margin included between its extremity and the radius; hence, while the narrow marginal area is broadest at the base and acuminate at its termination, the submarginal area is broadest either in the middle, or a little before the middle, and tapers gradually to its oblique apex. Cross veinlets abundant in the fore wing, those in the marginal area before the bulla well defined. At the terminal margin the longitudinal nervures are provided with curved simple branchlets, and there are no isolated veinlets. The two intercalar nervures of the anal-axillar interspace of the fore wing have simple branchlets, and usually the hinder one, close to its proximal extremity, curves forwards to unite with the other, which similarly curves forwards to join the anal nervure (Pl. X. 16 *c*); occasionally, especially in female specimens, a cross veinlet is transferred from near the wing-roots to establish communication between the first axillary and the anterior intercalated nervure (*l. c.* 16 *d*); less frequently, this last nervure annexes itself to the first axillary (*l. c.* 16 *e*). The figure 16 *i* exhibits a further departure from the normal neuration (supposing the insect to belong to this genus). In *A. annulata* from Ceylon, the two intercalated nervures referred to are abrupt and free at their proximal extremities as a rule (*l. c.* 16 *a*), but individual "sports" occur in which the anterior nervure imperfectly establishes direct communication with the anal nervure. Guard at the orifice of the mesothoracic spiracle small and triangular. Forceps-limbs of ♂ 3-jointed; the proximal joint much longer than the remainder, somewhat compressed, and in its basal half broadly dilated beneath; the deflexible basis, usually prominent in the middle of its distal border, is otherwise merely emarginate; the corresponding lobe in ♀, usually bifid and sharply excised with acute triangular points, is seldom emarginate only. Segments

6–10 constitute about $\frac{1}{2}$ of the abdomen; segment 8, the longest, is nearly equalled by segment 7; the others are successively shorter. Median caudal seta about as long as the others, seldom thrown off by specimens; outer setæ, in both sexes, usually double (in some species treble) the length of the body. Tarsal ungues all nearly alike, small, narrow, and hooked at the tip. In normal species the ♂ fore tarsus is nearly as long as the tibia, or a little longer than it, and the latter is about $1\frac{1}{2}$ as long as the femur; the ♀ fore tarsus is nearly $\frac{1}{2}$ the length of the tibia, and this about $1\frac{1}{3}$ as long as the femur; in both sexes the tarsal joints, arranged in diminishing succession, rank thus:—3, 2, 4, 5, 1. Hind tarsus usually about $\frac{1}{2}$ the length of the tibia. Some Cingalese species have the ♂ fore tarsus rather shorter than the tibia, and the joints in diminishing order rank 2, 3, 4, 5, and 1, while the hind tarsus is scarcely $\frac{1}{4}$ as long as the tibia.

Nymph unknown.

Type. A. australis (in *Ephemera*), Walker.

Distribution. S. Africa, Ceylon, Australasia, Japan (undescribed sp.), and S. America.

Etymology. ἀταλός and φλέβιον, in allusion to the delicacy of the cross veinlets of the wings of some species.

In the absence of female examples of most of the species, I am unable to separate satisfactorily those referred to above, as deviating from the typical form, from the others which exhibit the normal characteristics of the genus. Judging from analogy, there is much probability that the differences in the proportions of the setæ to the body, and in the proportional lengths of the joints of the limbs, distinguishable in the adult flies, are attended with manifest differences in the nymphs. The nymphs should be searched for under stones in shallow water at the borders of streams, or in proximity to the outflow of pools in river-beds, where the current is gentle. Favourable sites would be indicated by females alighting upon the water to oviposit, and by the departure from it of subimagines.

ATALOPHLEBIA FASCIATA, Hag. Plate LXIV. 1 (penis).

Potamanthus fasciatus, ! Hag., Verh. zool.-bot. Gesells. Wien, viii. 476 (1858) [part].

Imago (*dried*), ♂.—Thorax testaceous, with a brown-ochreous longitudinal stripe in the midst of the mesonotum followed by some dark blackish clouds near the peak. Abdomen very pale ochreous, approaching dull straw-colour; segments 2–8 and 10, narrowly edged at the tips with pitch-black, segments 7 and 8 ochreous-brown above, the two following yellow ochreous; venter subochraceous, slightly darkened at the joinings of the segments. Setæ clove-brown, their joinings near their insertions dark; forceps lutescent. Wings vitreous; fore wings faintly tinted with yellowish in the marginal and submarginal areas, and provided with about 20 simple slightly curved cross veinlets in the pterostigmatic space; longitudinal neuration yellowish, cross veinlets black, many of those in the anterior portion of the fore wing and some near the wing-roots edged narrowly with black. Legs fusco-lutescent, the femora banded in the middle, broadly but not strongly, with darker. Length of body 11, wing 15, setæ 35 mm.

Hab. Rainbodde, Ceylon, at an altitude of over 4000 ft. The subimago formerly attributed to this species is a female *Ephemera supposita*. The coloration of the body

of the type specimen, the subject of the above description, may have been modified by ravages of *Anthrenus* (Hag. Mus.).

ATALOPHLEBIA ANNULATA, Hag. Plate X. 16 *a* (♂ , wings, legs, and genitalia).

Potamanthus annulatus, ! Hag., Verh. zool.-bot. Gesells. Wien, viii. 476 (1858).

Leptophlebia annulata, ! Etn., Trans. Ent. Soc. London (1871), 82, pl. iv. 23–23 *b*; Hag. & Etn., *op. cit.* (1873), 393–4.

Subimago (*dried*).—Wings brownish grey, translucent; neuration dull black, excepting that some of the longitudinal nervures are lighter in colour towards the wing-roots.

Imago (*dried*), ♂.—Thorax and legs pitch-brown, the ungues and at least the last tarsal joint subtestaceous. Dorsum of abdomen from its extremity to almost the base of the 7th segment pitch-brown; segments 2–6 each banded with piceous and very pale translucent dull brownish yellow, the dark terminal band dilated triangularly in the middle, and the pale band at the sides; there is also a very narrow pale band at the base of the seventh segment; venter pitch-brown at the joinings and throughout the last three segments, otherwise concolorous with the pale dorsal bands. Forceps pitch-brown; setæ warm sepia-brown or fuliginose. Wings vitreous, with pitch-black neuration; the fore wings tinged slightly with piceous near the wing-roots and the great cross vein, and for a short distance in the submarginal area; the remainder of this last, and the pterostigmatic space, is faintly tinted with fuscous, and there are about 16 simple gently curved cross veinlets in this space. Length of body, ♂ 9–11; wing 12·5; setæ 35 & 37 mm.

Hab. Rainbodde, Ceylon, at upwards of 4000 feet altitude (Hagen Mus., & Thwaites in McLach. Mus.; also Brit. Mus.).

ATALOPHLEBIA TAPROBANES, Walk. Plate X. 16 *b* (penis).

‡*Baëtis Taprobanes*, ! Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 567 (1853); Hag., Verh. zool.-bot. Gesells. Wien, viii. 476 (1858).

Leptophlebia Taprobanes, ! Etn., Trans. Ent. Soc. London (1871), 82, pl. iv. 22, 22 *a* [details]; Hag. & Etn., *op. cit.* (1873), 393.

Imago (*dried*), ♂.—Thorax pitch-black; abdomen scarcely lighter, excepting in the translucent whitish bases of segments 2–6. Setæ burnt-umber brown. Fore legs black; hinder legs dark piceous. Wings vitreous, very faintly tinted with very light bistre-grey, with a streak at the great cross vein, a spot at the wing-roots, and with the marginal and submarginal areas of the fore wing beyond the middle burnt-umber brown; neuration pitch-black. The marginal area of the fore wing contains about 8 cross veinlets before the bulla, and 18 straight and simple beyond it. Length of body, ♂ 12; setæ 30 (or more) mm.

Hab. Ceylon (Brit. Mus.).

ATALOPHLEBIA FEMORALIS, Hag.

Potamanthus femoralis, ! Hag., Verh. zool.-bot. Gesells. Wien, viii. 476 (1858).

Leptophlebia femoralis, Etn., Trans. Ent. Soc. London (1871), 83; Hag. & Etn., *op. cit.* (1873), 394.

Subimago (*dried*).—Wings transparent, pale sepia-grey, with fuscous neuration. Setæ brown.

Imago (*dried*).—Thorax glossy, dark chestnut-brown. Abdomen in ♂ above, as far as the base of the 6th segment, translucent whitish tinged with fuscous, the remainder fuscous, all the segments narrowly margined with pitch-black at the joinings; venter similarly pale to the seventh segment, and then fuscous or ochraceous, and likewise piceous at the joinings; in the ♀ type all is discoloured. Setæ light sepia-brown; forceps defective in the type. Legs in ♀ with pale flavescent femora banded broadly in the middle and narrowly at the tip with black, the tibiæ and tarsi pale dull burnt-umber brown; the hinder legs of ♂ are paler, with sepia-brown tibia and tarsus; its fore legs are lost. Wings vitreous, with piceous neuration and a rounded brown-tinted cloud at the wing-roots; cross veinlets in the pterostigmatic space about 10 in number in ♂, 13 in ♀. Length of body, ♂ 8; wing, ♂ 9·5, ♀ 8; setæ, ♂ about 23, ♀ 15 mm.

Hab. Rainbodde, Ceylon, at an altitude of over 4000 feet (Hag. Mus.).

Atalophlebia australis, Walk.

‡ *Ephemera australis*, ! Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 538.
Leptophlebia australis, ! Etn., Trans. Ent. Soc. London (1871), 78, pl. iv. 14–14 *b* [details].
Atalophlebia [type] *australis*, ! Etn., Ent. Mo. Mag. xvii. 193 (1881).

Subimago (*dried*).—Wing neuration pitch-brown, the cross veinlets bordered with light bistre-brown, their bordering in the fore wing confluent along the sides, of a lambda-shaped space free from cross veinlets and colouring, the long stroke of the letter being represented by a narrow clearing describing a gentle curve from the apex to the anal angle of the wing, and the short stroke by another narrow clearing running out from the midst of the wing-roots to the former. In some specimens the short clearing at the base of the wing is isolated by colouring from the longer clearing.

Imago (*dried*), ♂.—Thorax pitch-black above. Abdomen rufo-piceous above; venter dull light burnt-umber, approaching rusty brown. Setæ light rufo-piceous. Wings vitreous, their neuration light pitch-brown; the pterostigmatic space of the fore wing, tinged with greenish grey, contains many oblique nearly straight cross veinlets sparingly conjoined; the marginal area contains, approximately, 7–9 cross veinlets before the bulla, and 21 between it and the apex of the wing. Fore legs with the femur pitch-brown, the tibia pitch-black, and the tarsus light burnt-umber; hinder legs rufo-piceous, with rather lighter tarsus, and with a faint black band in the middle and another at the tip of the femur. Length of body, ♂ 7–10; wing 9–11; setæ 23 & 22 mm.

Hab. Tasmania (Brit. Mus.).

Atalophlebia australasica, Piet. Pl. X. 16 *c* (wings and penis).

‡*Baëtis australasica*, Piet., Hist. Nat. Névropt. ii. Ephém. 189, pl. xxiv. 1, 2 (1843–5); Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 559.
Leptophlebia australasica, ! Etn., Trans. Ent. Soc. London (1871), 78, pls. ii. 2 [wing], and iv. 15–15 *b* [details].

Subimago (after Pictet's figure).—Wings light black-grey, with dark neuration.

Imago (*dried*).—Thorax pitch-black above. Abdomen in segments 2–8 rufo-luteous marked with pitch-black, viz. each segment with an abbreviated black line from the base in the middle, a round black spot on each side of the middle at the tip, and a stripe on

each side descending obliquely from the hinder border of the segment almost to its base, dilated very broadly in front on its lower side so as to resemble somewhat a quadrangular blotch squarely excised at its lower distal angle; segment 9 pitch-black excepting at its rufo-luteous distal margin. Forceps rufo-lutescent at the base, becoming rufo-piceous distally. Setæ intense warm sepia-brown. Wings vitreous, sometimes faintly tinted with lurid in the disk; their neuration pitch-black; the marginal and submarginal areas of the fore wing tinged with burnt-umber brown, and more deeply so in the pterostigmatic space, where the cross veinlets (mostly simple) are crowded and oblique; of these there are about 8 before and 23 beyond the bulla in the marginal area. Fore legs pitch-brown; hinder legs rufo-luteous; all with two black bands on the femur. Ventral lobe of the penultimate segment of the ♀ excised. Length of body, ♂ 9–10; wing, ♂ ♀ 11; setæ, ♂ 32 mm.

Hab. Sydney, and perhaps Melbourne (Brit. Mus.).

Atalophlebia furcifera, Etn.

Leptophlebia furcifera, ! Etn., Trans. Ent. Soc. London (1871), 79, pl. iv. 16–16 *b* [details].

Imago (*dried*), ♂.—Mesothorax brownish luteous above; metatergum deep sanguineous-black. Abdomen sanguineous black, with a median longitudinal line, the spiracular lines, and triangular spots, one on each side of the dorsum, adjacent to the hinder border in segments 2–6, of a lighter colour. Setæ cretaceous, with the alternate joinings black. Wings vitreous, iridescent, with piceous nervures; the pterostigmatic region of the fore wing rufo-fuscescent, with numerous simple and nearly straight cross veinlets; the other cross veinlets in the front of the fore wing, as far back as the radius and first of the sectors, bordered with rufo-fuscous; the bullæ of the subcosta and radius, and the point of furcation of the præbrachial (6), are surrounded each by a small warm-sepia nebula. Fore legs deficient; hinder legs testaceous, with two femoral bands, and the base of the trochanter fuscous. Length of body and wing, ♂ 11; setæ 13 and 16 mm.

Hab. Melbourne (M'Coy). The species was forwarded to Mr. F. Walker, who referred it to me; the type may therefore be in the Melbourne Museum. The name has reference to the form of the penis.

Atalophlebia inconspicua, Etn.

Leptophlebia inconspicua, ! Etn., Trans. Ent. Soc. London (1871), 79, pl. iv. 17–17 *b* [details].

Imago (*dried*), ♂.—Abdomen piceous posteriorly, paler in the intermediate segments, with small, oval, yellowish dorsal spots at the sides. Setæ fuscous, with darker joinings. Wings faintly lutescent, with piceous neuration: the pterostigmatic portion of the fore wing contains a few simple, straight, oblique cross veinlets. Legs piceous; sometimes the fore tarsi and the hinder legs are lighter. Lobes of the penis broadly flattened out and obtuse. Length of ♂, body 5–6; wing 6–7 mm.

Hab. Adelaide (Hope Mus., Oxford).

ATALOPHLEBIA DENTATA, Etn.

Leptophlebia dentata, ! Etn., Trans. Ent. Soc. London (1871), 80, pl. iv. 18–18 *d* [details].

Subimago (*dried*).—Wings very light sepia-grey, the cross veinlets very faintly and very narrowly bordered with darker grey; neuration pitch-black, but brownish at the wing-roots. Setæ deep warm sepia-brown.

Imago (*dried*).—Thorax bright brown-ochre above. Abdomen light bistre-brown, modified in segments 8–10 with burnt-umber, the segments narrowly bordered with black at their tips. Forceps lutescent. Setæ pilose, either lutescent or very light bistre-grey, with black joinings. Wings vitreous, the disk very faintly tinted with yellowish; marginal and submarginal areas of the fore wings coloured with dark amber-yellow (raw sienna), the submarginal wholly, the marginal area only in part, viz. from the base to the middle and in the distal portion of the pterostigmatic space completely, but only in about half its breadth along the subcosta in the intervening space; the cross veinlets in the marginal area before the pterostigmatic space and those in the submarginal area are bordered with dark bistre-brown, and give rise to a blotch or cloud at the bulla. Neuration mostly pitch-black, but the nervures near the wing-roots, and the stouter portions of the costa, subcosta, and radius are pitch-brown. Cross veinlets in the marginal area about 5 before and 15 beyond the bulla, all straight. Legs luteous, the fore tarsus lighter and dull, the femora more or less dark at the knee, the fore tibia black at its distal extremity, the tarsal joinings piceous. ♀. Ventral lobe of segment 9 emarginate. Length of body, ♂ 8, ♀ 7–9; wing, ♂ 11, ♀ 7–13; setæ, ♂ 18, ♀ 15–16 mm.

Hab. New Zealand (Brit. Mus.).

ATALOPHLEBIA STRIGATA, Etn. Plate X. 16 *d* (fore leg, ♀, and hind wing).

Leptophlebia strigata, ! Etn., Trans. Ent. Soc. London (1871), 80, pl. iv. 19 [detail, ♀].

Imago (*dried*), ♀.—Thorax brown-ochreous above, with two subparallel longitudinal black stripes on each side of the pronotum (one at the lateral border, and the other midway between it and the median line of the notum), and also with the longitudinal furrows in advance of the wing-roots of the mesonotum black. Abdomen light Indian red, with four longitudinal black dorsal stripes and a median black ventral line extending its whole length; each stripe is mainly composed of truncate triangular spots in mutual contiguity, one spot in every segment; but in some of the posterior segments the spots become oblong or linear, and are somewhat suffused with the ground-colour; the component spots of the two inner stripes taper behind, those of the outer stripes point forwards and downwards: the two inner stripes are rather near together, and enclose a narrow streak of the ground-colour, whose edges are even, along the track of the dorsal vessel; the outer and the inner stripes of each side are farther apart, and give a serrated outline to the interspace between them, so that the ground-colour thereabouts in every segment takes the form of an oblong spot, placed obliquely in the anterior segments, but longitudinally in the hinder segments; the outer dorsal stripe on each side is separated by a narrow interval from the spiracular borders of the segments, excepting at the extreme base of each. Setæ light brown-ochreous, with reddish brown joinings. Legs,

in opaque view, of a dull colour approaching brown-ochreous, the femora banded in the middle and distally with light burnt-umber brown, the tarsi and hinder tibiæ much lighter in colour than the femora, with a dark spot at the extremity of the fore tibia, and with the ungues, the extremities of the terminal joints, and the extreme distal edges of the remaining tarsal joints light burnt-umber, or almost madder-brown. Fore wings vitreous, with the marginal and submarginal areas, the costa, subcosta and radius, and the bases of the other longitudinal nervures light raw-umber brown, changing in transmitted light to light brownish-amber; the remainder of the longitudinal neuration and many of the cross veinlets in the outer and hinder portions of the disk of the wing are pitch-black in opaque view, changing in other lights to pitch-brown; but the stronger cross veinlets near the base and those between the great cross vein and the bulla in the marginal and submarginal areas, being slightly thickened, are more constantly black; at the wing-roots all of the strong nervures are light raw-umber or brownish amber; the marginal area contains 8 cross veinlets before and 15 beyond the bulla, all of them simple. Length of body, ♀ im. 11, wing 16, setæ 23 and 22 mm.

Hab. North Australia. This description is prepared from the original type specimen in McLach. Mus. The dimensions formerly attributed to it were very inaccurate.

Atalophlebia costalis, Burm.

‡*Baëtis*‖ *costalis*, Burm., Handb. d. Ent. Bd. ii. Abth. ii. 800 (1839).

Potamanthus costalis, Pict., Hist. Nat. Névropt. ii. Ephém. 237 (1843–5); Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 546 (1853).

Leptophlebia costalis, Etn., Trans. Ent. Soc. London (1871), 81.

Subimago (*dried*).—Black; thorax with a whitish line in front of the wings; abdomen and legs banded with red. Wings suffumatose, with all the cross veinlets in the marginal and submarginal areas of the fore wing brownish. Length of body, ♂ 6 Paris lines. (After Burm.)

Hab. Australia.

Atalophlebia nodularis, Etn. Plate X. 16 *e* (hind wing and two views of penis).

Leptophlebia nodularis, ! Etn., Trans. Ent. Soc. London (1871), 81, pl. iv. 20–20 *c* [details].

Subimago (*dried*).—Wings light sepia-grey, with dark neuration; cross veinlets, of the fore wing only, bordered with medium sepia, their bordering in some measure confluent in the disk near the subcostal bulla (which itself is surrounded by a darker spot), and again beyond this about midway towards the tip, so as to form an ill-defined irregular cloud enclosing a lighter space of the ground-colour.

Imago (*dried*), ♂.—Thorax piceous or pitch-black. Abdomen discoloured, pitch-black, with translucent subtriangular spaces in segments 2–5, one on each side of a dark median longitudinal line, extending from the base nearly to the hinder border of the dorsum. Setæ yellowish white, annulated broadly with pitch-brown in the alternate joints. Wings vitreous, with pitch-black neuration; fore wing, in opaque view, with the marginal and submarginal areas, from the great cross vein to the roots, raw-umber brown, and with narrow dark borders to the cross veinlets, nearly effaced in the disk, but subopaque in the

marginal and submarginal areas; in the submarginal area and the next behind it, in both of the places that are clouded in the subimago, three cross veinlets are nearly approximated to one in a conspicuous manner, and are very faintly clouded. Fore tibia and tarsus, in opaque view, dull luteo-rufescent, the femur obscure rufo-piceous, with a black band in the middle and another at the knee, a black spot at the extremity of the tibia, and the joinings of the tarsus narrowly black; hinder legs, in opaque view, redder, with only the band in the middle of the femur: in transmitted light the prevailing colour of the legs is brownish amber. Length of body, ♂ 9, wing 10–12, setæ 16 mm.

Hab. Christchurch, New Zealand (Fereday in M'Lach. Mus.). The present photo-lithograph lacks definition, and is inferior to the figure published in 1871, copied from the same original drawing.

ATALOPHLEBIA SCITA, Walk. Plate X. 16*f* (penis).

‡*Baëtis scita*, ! Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 570.
Leptophlebia scita, ! Etn., Trans. Ent. Soc. London (1871), 81, pl. iv. 21, 21 *a* [details].

Subimago (*dried*).—Wings dark warm sepia-grey, with black neuration; the cross veinlets of the fore wing are edged with darker grey; their scarcity behind the subcosta in the middle of the front of the disk gives rise to the appearance of a pale spot, whilst the mutual approximation of three or four about the bulla and again in the midst of the pterostigmatic space produces frequently two dark spots. Setæ warm sepia-grey with black joinings.

Imago (*dried*), ♂.—Thorax light reddish or pitch-brown. Abdomen dark bistre-brown, the segments above broadly edged distally with black, and segments 3–6 above marked, close to the base, each with a pair of translucent yellowish triangular spots in the midst. Forceps luteous. Setæ dirty white, or light sepia-grey, annulated at the base of every alternate joint with black, the annulations gradually increasing in breadth, until, in the distal parts of the seta, each annulation occupies almost the whole of a joint. Fore femur, in opaque view, translucent raw umber-brown, with a distinct black band in the middle, and a fainter one at the tip; tibia and tarsus light rufo-luteous, with the tip of the former and joint 1 of the latter black: in transmitted light the femur becomes chiefly brownish amber, and the rest of the leg light yellowish-amber. Hinder legs amber-yellow with a black band in the middle of the femur, and with the terminal borders of the tibia and tarsal joints very narrowly edged with black. Wings vitreous, with pitch-black neuration; the fore wing with a spot at the base of the costa, and with the narrow bordering of the cross veinlets in the marginal and submarginal areas piceous; also with a less distinct spot in the marginal area at the bulla, and another in the pterostigmatic space, light raw-umber or light bistre-brown. In the marginal area are 7–8 cross veinlets before the bulla and 11–13 beyond it, mostly simple and free.

♀ very similar. The cross veinlets in the marginal area of the fore wing rather more numerous than in the male (but of similar character), viz. 9 before, 18 beyond the bulla. Length of body, ♂ 6, ♀ 9; wing, ♂ 7–8, ♀ 11 mm.

Hab. New Zealand (Brit. Mus. & M'Lach. Mus.). The figure of the penis in the

present work was drawn from a specimen in the latter collection; but the earlier figur was prepared from a type specimen.

ATALOPHLEBIA CHILENSIS, n. sp. Plate X. 16 *g* (♂ , legs and genitalia).

Subimago (dried).—Wings extremely light smoky-grey, with pitch-black cross veinlets bordered narrowly with light Cologne-earth grey, so arranged in the fore wing as to leave a blotch of the ground-colour extending from the costa to about the pobraehial (7) nervure; the longitudinal nervures pale for some distance from the wing-roots. Setæ light warm sepia-grey with pitch-black joinings.

Imago (dried), ♂ .—Thorax brown-ochreous above. Abdomen discoloured, collapsed, and translucent; segments 1–6 narrowly pitch-black at the tips, with an oblique dorsal stripe on each side from the terminal border, and a spot on each side at the base fuscous. Setæ deficient. Wings vitreous, with light amber-yellow longitudinal nervures and black cross veinlets; these are thickened somewhat in the marginal and submarginal areas of the fore wing; the former area contains about 9 cross veinlets before, and 16, straight and simple, beyond the bulla. Legs, in opaque view, rufo-luteous, with the fore tibia luteous, the hinder tibiæ towards their extremities and the tarsi paler or subtestaceous; a black band in the middle and another (or a spot) at the tip of the femur, also a spot at the tip of the tibia, pitch-black. Length of body, ♂ 10, wing 12; setæ, ♂ subim. 12 mm.

Hab. Chili (Reed, in M^c^Lach. Mus.).

ATALOPHLEBIA TABULARIS, n. sp. Plate X. 16 *h* (♂ head, parts of tarsi, forceps, and penis).

Imago (in spirits), ♂ .—This species, well characterized by the lobes of the penis being, as is represented in the figure, flat and obliquely pointed, so as to resemble in combination the nib of a pen flattened, has a slight projection in the middle of the terminal border of the forceps basis. Eyes clove-brown. Thorax piceous above, darker than the abdomen. Setæ whitish, with their alternate joinings dark. Femora banded with black in the middle and at the knee. Wings vitreous; the marginal area of the fore wing contains about 10 cross veinlets before the bulla, and after that 6 rather weak, followed in the pterostigmatic region by 13 well-defined mostly simple and slightly curved, rarely (and then only very sparsely) connected together. Length of wing 9 mm.

Hab. Cape of Good Hope, on Table Mountain. The only specimen obtained was found in 1874, floating on the streamlet at the Platteklip. The nymph was vainly sought for in the haunts of *Telphusa*; the disuse of the net may have caused the failure.

LEPTOPHLEBIA, Westw. 1840 (*part*); *restricted*, Etn. 1881.

Illustrations. Adult (details) Pl. XI. 17 *a–d* (whole figures); consult Pictet, *op. cit.* pl. 26 (*Pot. Geerii & castanea*). *Nymph* Pl. XXXII.; also Pictet, *loc. cit.* (1843–5) [who omits the tracheal branchiæ of segment 1 of the abdomen].

Adult.—Hind wing in front unequally and very flatly arcuate, the curvature of the arch being strong at both ends, and interrupted by a very shallow depression nearly in its middle, immediately beyond its obtusely rounded summit; the radius (3) constitutes, as

it were, the chord of this arch; the subcosta (2), receding in a bold curve from the radius, approaches the summit of the same arch, and then takes a nearly straight course, subparallel with the larger segment of the costal border, to terminate obliquely in the margin rather near the extremity of the radius. Hence the marginal area of that wing is sublinear, dilated in front at the base, and acuminate at the point; while the submarginal area is broadest in its first $\frac{1}{4}$, and thence is gradually narrowed in a slight degree to its oblique, roundly truncate extremity. Cross veinlets abundant, present, but often weak, in the marginal area of the fore wing before the bulla. The longitudinal nervures are furnished with branchlets along the terminal margin, which are partly simple and curved, and partly common to both of the adjacent nervures; there are no isolated veinlets. In the anal-axillar interspace of the fore wing, the two long intercalar nervures communicate mutually by means of cross veinlets, and exhibit the greatest possible diversity in their ultimate destination inwards. Either of them may be the longer of the two, and may annex itself to either the anal or the first axillar, while the shorter remains abrupt; or both of them may annex themselves to the one or the other of these nervures; or each of them may annex itself to that nervure to which it is nearest; or both may terminate abruptly, communicating with those nervures by means of cross veinlets only. This last arrangement prevails in our native species; but the variations from it, noted above, are quite independent of species and sex, and are apt to mar individual symmetry. Guard at the orifice of the mesothoracic spiracle small and triangular. Forceps-limbs of ♂ essentially 3-jointed (a minute terminal 4th joint is of occasional individual occurrence); the proximal joint normally much longer than the remainder, compressed and dilated towards the base; the dilatation, usually gradual and at the lower edge, is in *L. mollis* sudden and superior. The species *L. præpedita*, provisionally referred to this genus, has 4-jointed forceps-limbs with a short joint at the base, like *Choroterpes*. Abdomen proportioned nearly as in *Atalophlebia*; the deflexible basis of the ♂ forceps, and the homologous lobe in the ♀, are deeply and sharply excised or bifid, with acute triangular points. Median caudal seta subequal to the others; outer setæ in ♂ about $1\frac{1}{2}$ as long as the body, in ♀ nearly of equal length with the body. Tarsal ungues all dissimilar each to the other. Fore tarsus of ♂ little longer than the tibia, which is nearly of the same length as the femur; the joints in diminishing sequence rank 2, 3, 4, 5, and 1. Fore tarsus of ♀ about $\frac{1}{2}$ as long as the tibia, which is little longer than the femur; its joints rank 2, 3, 5, 4; hind tarsus (exclusive of joint 1) almost $\frac{1}{2}$ as long as the tibia and joint 1 combined; its joints rank 5, 2, 3, 4; the first joint is obsolescent in these tarsi. *Nymph* latent; abdominal tracheal branchiæ uniform, bipartite, inserted at the latero-dorsal angles of the segments; their divisions simple, subulate or linear-acuminate, beset with minute distant hairs; the hinder pairs in repose widely divergent backwards from the sides of the body. Caudal setæ nearly $1\frac{1}{2}$ as long as the body, and, like the setaceous antennæ, provided with verticils of minute spreading hairs at the joinings. Fangs of the mandibles strong and acute; appendage (endopodite) well developed, terminating in a compact oblique brush. Palpus of maxilla I slender; its last 2 joints together constitute about $\frac{3}{5}$ of the whole. Lacinia of maxilla II acutely semi-ovate and narrow, the inner edge rather concave. Tongue broadly obovate, retuse

distally; paraglossæ obtuse, broadly dilated. Body slender, tapering evenly backwards in a small degree. Hind leg the longest; the tarsus almost as long as the tibia (excluding the claw).

Type. *L. marginata* (in *Ephemera*), Linn.

Distribution. Northern temperate regions; also (undescribed sp.) Chili.

Etymology. λεπτός and φλέβιον, from the tenuity of the cross veinlets.

I have seen nymphs of *L. submarginata, cincta,* and an undetermined Portuguese species alive, and some of an American (Portland, Or.) species forwarded by Dr. Hagen in spirits.

LEPTOPHLEBIA MARGINATA, Linn. Pl. XI. 17 *a* (wings, legs, and forceps).

Ephemera marginata, Linn., Syst. Nat. ed. xii. pars ii. 906 (1767); Fab., Syst. Ent. 303 (1775); *id.,* Sp. Ins. i. 384 (1782); *id.,* Mant. Ins. i. 243 (1787); Vill., C. Linn. Ent. iii. 17 (1789); Gmél., Linn. Syst. Nat. ed. xiii. i. pars v. 2628 (1790); Ol., Encycl. Méthod. vi. 417 (1791); Fab., Ent. Syst. emend. iii. pars i. 69 (1793); Schr., Fn. Boica, ii. pars ii. 198 (1798); Ccd., Fn. Ingricæ Prodr. 134 (1798); Walck., Fn. Par. ii. 8 (1802); Lat., Hist. Nat. d. Crust. & Ins. xiii. 95 (1805); Shaw, Gen. Zool. vi. part ii. pl. lxxxi. (1806); Stewart, Elem. Nat. Hist. Anim. K. ed. ii. ii. 225, pl. xvii. 14, 15 (1817); ! Steph., Ill. Brit. Ent. vi. 57 (1835); Zet., Ins. Lap. col. 1044 (1840); Blanch., Hist. Nat. d. Ins. iii. 54 (1840).—*E. viridescens,* Fourcroy, Ent. Par. ii. 351 (1785).—*E. procellaria,* Schwarz, Nomencl. Rœs. Ins. Bclust. pl. xii. 1–3 (1793–1830).—*E.* ‖ *stigma,* ! Steph., Ill. Brit. Ent. vi. 56 (1835).—*E. talcosa,* ! Steph., *op. cit.* vi. 57 (1835).

Potamanthus stigma, Pict., Hist. Nat. Névropt. ii. Ephém. 235 (1843–5); Walk., List Neuropt. Brit. Mus. part iii. 541 (1853).—*P. talcosus,* Pict., *op. cit.* 234 (1843–5); Walk., *op. cit.* 541 (1853).—*P. marginatus,* Hag., Ent. Ann. (1863), 17; *id.,* Stet. ent. Zeit. xxvi. 229 (1864); Packard, Guide to Study of Ins. ed. i. 595, fig. 577 (1870).

Leptophlebia marginata, Etn., Trans. Ent. Soc. Lond. (1871), 84, pls. ii. 2 *a* (wing) & iv. 25, 25 *a–b* [details]; Hag., *op. cit.* (1873), 395; Meyer-Dür, Bull. Soc. Ent. Suisse, iv. 317 (1874); Rostock, Jahresb. d. Ver. f. Naturk. Zwickau, 1877, p. 84 (1878).

Subimago (*living*).—Wings either sepia-brown- or grey-black-tinted, the hinder pair either in part (towards the base) or altogether paler; cross veinlets in the fore wing and towards the terminal border of the hind wing narrowly edged with black-grey; neuration translucent yellowish.

Imago (*living*), ♂.—Eyes intense sepia-brown, or brown-black. Notum of thorax at first pitch-brown, changing to jet-black. Abdomen pitch-brown, with the first 4–5 dorsal joinings usually pale and translucent, the others flavescent or lutescent, and with the last two or three ventral segments as well as the ventral ganglia pitch-brown, the former with paler joinings; but sometimes the pale dorsal segments are cinereous, with dark spiracular lines and with luteous ventral ganglia. Fore legs pitch-black with cinereous or greyish tarsi; hinder legs dark pitch-brown, the tibiæ and tarsi paler and often of a pale reddish sepia-brown. Wings pellucid, with pale pitch-brown neuration, the fore wings sometimes brown-tinted in the vicinage of the pterostigmatic space. Setæ black or greyish, with the joinings very narrowly opaque. Forceps paler than the 9th segment. The reclinate appendages beneath the lobes of the penis are closely appressed to the lobes, and are obliquely truncate at the points.

♀ much like the ♂, with the fore tibiæ pale reddish luteous; abdomen opaque, pitch-brown above, and intense sepia-brown beneath. Length of body 6–12; wing 6–11; setæ, ♂ im. 12–20, subim. 9, ♀ im. 8–16 mm.

Hab. Temperate and Arctic Europe and America; also Turkestan (Fedtschenko Exp.). In cold regions the flies appear in the height of summer, elsewhere in spring, early summer, and the autumn. Mr. Albarda sent me specimens of a species found in Holland, apparently distinct from, but very nearly related to, *L. marginata*. An accidental loss of the detailed drawings precludes its description.

Leptophlebia submarginata, Steph.

Ephemera submarginata, ! Steph., Ill. Brit. Ent. vi. 58, no. 7 (1835).—*E. dispar*, ! *id., op. cit.* vi. 58, no. 8 (1835).—*E. helvipes*, ! *id., op. cit.* vi. 59, no. 14 (1835).

Potamanthus Geerii, Pict., Hist. Nat. Névropt. ii. Ephém. 211, pl. xxvi. 1–3 (1843–5); Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 541 (1853); Brauer, Neuropt. Austr. 27 (1857); Hag., Ent. Ann. (1863), 18; Ausser., Ann. d. Soc. Natur. Modena, An. iv. 136 (1869).—*P. dispar*, Pict., Hist. Nat. Névropt. ii. Ephém. 234 (1843–5); Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 542 (1853).—*P. helvipes*, Pict., Hist. Nat. Névropt. ii. Ephém. 235; Walk., List &c. part iii. 543 (1853).—*P. submarginatus*, Pict., Hist. &c. 236 (1843–5); Walk., List &c. part iii. 545 (1853).

? ‡ *Baëtis reticulata*, Burm., Handb. d. Ent. Bd. ii. Abth. ii. 801 (1839); Pict., Nat. Hist. Névropt. ii. Ephém. 192 (1843–5); Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 561 (1853).

‡ *Cloeon* ‡ *culiciformis*, ! Walk., *op. cit.* part iii. 576 (1853).

Leptophlebia helvipes, ! Etn., Trans. Ent. Soc. London (1871), 85, pl. iv. 26–26 *d* [details]; Meyer-Dür, Bull. Soc. Ent. Suisse, iv. 317 (1874); Rostock, Jahresb. d. Ver. f. Naturk. Zwickau, 1877, p. 84 (1878).

Subimago (*living*).—Wing-membrane fawn-colour or smoke-grey, with black cross veinlets broadly edged with grey-black; these are so arranged as to leave a clear space of the ground-colour in the midst of the fore wing, extending transversely to a variable distance from the costa, and sometimes enclosing a small group of crowded cross veinlets adjacent to the bullæ; there is often another similarly pale space at the base of the wing, reaching from the anal (8) nervure to the inner margin, and from the wing-roots to the confines of the intercalar nervures of the anal-axillar interspace. Legs of ♀ piceous, with black tarsi.

Imago (*living*), ♂.—Eyes dull rufo-piceous or dark purple-brown above, fuscous beneath. Thorax jet-black above. Abdomen pitch-brown on the dorsum, with the joinings of the intermediate segments whitish grey; segments 7–10 darker than the preceding, and with flavescent joinings. Venter light warm sepia-brown, with joinings as above; segments 8 and 9 pitch-brown, lutescent posteriorly; dark rusty spots indicate the ventral ganglia. Forceps furfurosus. Setæ warm sepia-grey, with darker joinings. Wings vitreous, with the stronger nervures furfurosus or amber-brown. Fore legs black, with grey-black tarsi, or with the femur pitch-black, and the remainder black. Hinder femora pitch-brown, the tibiæ and tarsi either dark warm sepia-grey, or sometimes yellowish brown or fulvescent.

♀ very like the ♂. Eyes pitch-brown. Setæ reddish brown, with dark joinings.

Length of body 9–11; wing 10–13; setæ, ♂ im. 12 & 13–14 & 16, subim. 7; ♀ im. 9–13, subim. 9 & 10–10 & 12 mm.

Hab. Great Britain; the Vosges (M'Lach.); Germany and Switzerland; in streams, lakes, and rivers. May to August. This species is easily distinguished from *L. marginata* by the form of the penis. Each of the lobes is widely dilated at its extremity; in dorsal view the dilated part is seen to be prolonged laterally into a short deflexed lanceolate projection; beneath the inner extremity of the lobe is a long slender subulate reclinate spur-like appendage.

Leptophlebia castanea, Pict.

Potamanthus castaneus, Pict., Hist. Nat. Névropt. ii. Ephém. 215, pl. xxvi. 4, 5 (1843–5); Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 542 (1853).

Leptophlebia castanea, Etn., Trans. Ent. Soc. London (1871), 86; Meyer-Dür, Bull. Soc. Ent. Suisse, iv. 310 (1874).

This species is distinguishable from *L. submarginata* by its smaller size, its thorax being no darker than the abdomen (which is of a uniform chestnut-brown), traversed in the mesonotum by a fine longitudinal light-coloured line. Legs and setæ unicolorous light brown. Wing-nervures whitish. Eyes of ♂ brick-red above. Length of body, ♀, and setæ 8; expanse of wings 17 mm.

Hab. At a swift stream at the extremity of Lake Leman, near the *marais de Villeneuve*, at the beginning of July. (After Pictet.) In 1879 I saw a ♂ subimago, seemingly of this species, in the Museum at Lyons.

Leptophlebia Meyeri, sp. nov. Pl. XI. 17 *d* (penis).

Imago (*dried*), ♂.—Thorax polished, deep black above. Abdomen piceous, with segments 3–6 or –7 translucent greenish-grey or brown. Wings vitreous; fore wing with the base and extremity of the costa, the subcosta and radius throughout, tinged with piceous or amber-brown; pterostigmatic space colourless, its veinlets somewhat crowded and curved, many of them also branched, with their branchlets anastomosing towards the costa. Legs dark piceous, the fore tarsus and the hinder tibiæ and tarsi blackish grey or fumatose, the last with the tips of the joints very narrowly darker. Ventral ganglia rufescent; forceps whitish; setæ fumatose or white, with rufescent joinings. Length of body 6–9; wing 7–10 mm.

Hab. Captured by Herr Meyer-Dür at Zürich and the Melch Alp, in July.—Easily recognized by the uncinate penis-lobes.

Leptophlebia cincta, Retz. Pl. XXXII. (nymph).

[*Ephemera*] or *E. cincta* [De G., Mém. pour serv. à l'hist. d. Ins. ii. pars ii. 650, pl. xvii. 17–18 (1771)]; Retz, C. De G. Gen. & Sp. Ins. 57 (1783).—*E.* ‡ *nigra*, Foureroy, Ent. Par. ii. 352 (1785).—*E. inanis*, or [*Ephemera*], [Zsch., Mus. Lesk. i. 50, no. 15 (1789)]; Gmél., Linn. Syst. Nat. ed. xiii. i. pars v. 2629 (1790); Ol., Encycl. Méth. vi. 421 (1791).—*E.* ‖ *albipennis*, Fab., Ent. Syst. emend. iii. pars i. 70 (1793).—*E.* ‡ *halterata*, Shaw, Gen. Zool. vi. part ii. pl. lxxxi. (1806).—*E. hyalinata*, Zet., Ins. Lap. col. 1044 (1840).

Potamanthus cinctus, Brauer, Neuropt. Austr. 27 (1857); Hag., Ent. Ann. (1863), 20; Ausser., Ann. d. Soc. Natur. Modena, Ann. iv. 137 (1869).—*P. inanis*, Pict., Hist. Nat. Névropt. ii. Ephém. 235 (1843–5); Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 544 (1853).—*P.* ‡ *halteratus*, Pict., Hist. &c. 236 (1843–5); Walk., List &c. iii. 546 (1853).—*P. hyalinus*, Pict., Hist. &c. 237 (1843–5).

Cloë fuscata, Piet, *op. cit.* 251, pl. xl. i. (1843–5); Onlianine, Neuropt. & Orthopt. of the Prov. of Moscow, p. 28 (1867).

Cloëon fuscata, Walk., List of Neuropt. in Brit. Mus. part iii. 573 (1853).

Leptophlebia cincta, ! Etn., Trans. Ent. Soc. London (1871), 87, pl. iv. 27 [detail]; Hag. & Etn., *op. cit.* (1873), 396; Meyer-Dür, Bull. Soc. Ent. Suisse, iv. 318 (1874); Rostock, Jahresb. d. Ver. f. Naturk. Zwickau, 1877, p. 84 (1878).

Subimago (*living*).—Wings black-grey [browner when dry], with the longitudinal nervures indistinctly yellowish. Thorax pitch-brown or pitch-black. Abdomen in segments 2–7 cinereous, the posterior segments fuscous, the joinings narrowly greyish-white.

Imago (*living*), ♂.—Upper eyes warm sepia-brown; lower eyes black. Thorax jet-black above. Abdomen seldom, or in large examples, uniformly raw umber- or pitch-brown above, usually so in segments 8–10 only, and in segments 2–7 vitreous; these are often faintly lutescent towards their hinder borders, their tracheæ are partly black near the spiracles, and the ventral nervous ganglia somewhat rusty; joinings of the opaque segments either light yellowish or reddish. Setæ and forceps whitish, the latter blackish grey towards the base, and sometimes 4-jointed instead of 3-jointed. Penis-lobes slightly divergent distally, each with a short acute projection on the outer side near the tip, and a long slender acuminate reclinate spur beneath (figured by me in 1871). Legs white or cretaceous, the fore femora darker than the hinder, the tibiæ and tarsi in some lights slightly tinged with testaceous. Wings vitreous; the stronger longitudinal nervures in opaque view faintly amber-colour (becoming pitch-brown in the dried insect); the marginal area of the fore wing in specimens of average or large size contains 10–14 very faint cross veinlets before the bulla, and beyond it 18–26, mostly stronger than the others, slightly sinuous, and in the pterostigmatic region commonly branched irregularly and anastomosing near the costa; in small examples there are about 8 before and 16 beyond the bulla, and the latter are sinuous, but less irregular than those of large specimens.

♀ (*living*).—Subsimilar to the ♂, with the stronger nervures of the wings piceous; the marginal area of the fore wing contains in large examples about 16 cross veinlets before, and 25–27 beyond the bulla; in small specimens, about 9 cross veinlets before, and 18–20 beyond the bulla; these in the pterostigmatic region are chiefly sinuous and generally simple. Abdomen fusco-piceous, with yellowish joinings; the setæ and legs testaceous, the hinder tarsi whitish. Length of body 7–8; wing 8–9; setæ, ♂ im. 8 & 9–8 & 11, subim. 9 & 7; ♀ im. 7 & 10–8 & 11 mm.

Hab. Northern and temperate Europe; in streams and rivers during the summer and autumn. Pictet probably confused this species with *Habrophlebia lauta* (to which his description of *Potamanthus* ‡ *cinctus* applies) because it was mingled with a *Habrophlebia* in his collection, and is found in the neighbourhood of Geneva. In September 1879 I found both of these species beside a stream at Troinex, near Mt. Salève.

LEPTOPHLEBIA VACIVA, sp. nov.

Subimago (*dried*).—Wings dark sepia-grey, with light reddish brown longitudinal nervures. Setæ sepia-grey. Legs of ♀ in opaque view yellowish testaceous; in transmitted light yellowish amber-colour.

Imago (*dried*), ♂.—Thorax jet-black above, at the sides pitch-black. Abdominal segments 2–6 and the base of segment 7 transparent white, with opaque white joinings and burnt-umber brown ventral ganglia, the other segments pitch-brown above; segment 8 beneath is more of a warm sepia-brown, and segment 9 somewhat rusty or reddened, the colouring extending a little into the forceps-basis. Setæ transparent, white; forceps-limbs cretaceous, tapering gradually from the base. Lobes of the penis slender, each with a single short and slender acuminate barb-like lateral appendage or process, projecting outwards obliquely at some distance before the tip. Fore legs in opaque view bistre-brown or pitch-brown, changing in transmitted light to brownish amber; hinder legs in a large measure transparent whitish, but tinged with a similar brownish tint towards the distal extremities of the femora and the extreme bases of the tibiæ, as well as in a still fainter degree towards the extremities of the tarsi. Wings vitreous, with the stronger longitudinal nervures light pitch-brown, changing with light transmitted to brownish amber; in the pterostigmatic space of the fore wing are about 8–12 slightly curved cross veinlets of a like colour, mostly simple and thickened towards the subcosta; in the remainder of the marginal area the cross veinlets are very indistinct. Length of body, ♂ 7·5, wing 8 mm.

Hab. Mt. Hood, Oregon (McLach. Mus.).

LEPTOPHLEBIA MOLLIS, Hag. MS. Plate XI. 17 *b* (forceps, from side and wings).

Cloë mollis, ! Hag., MS. (1861).
Leptophlebia mollis, ! Etn., Trans. Ent. Soc. London (1871), 88, pl. iv. 28 [details].

Subimago (*dried*).—Wings very light brownish white. Thorax dark brownish.

Imago (*dried*).— ♂. Thorax above either pitch-black, luteo-piceous, or rufo-piceous. Abdomen in segments 2–7 translucent whitish, the tips of the dorsal and sometimes also of the ventral segments greyish, and the ventral ganglia rufescent; segments 10–8 and the extremity of segment 7 rufo-piceous or luteo-piceous. Forceps-limbs dilated somewhat suddenly towards the base. Coxæ and fore femora towards the tips in opaque view somewhat light testaceous or rufo-piceous, changing in transmitted light to pale amber; hinder femora lighter; the rest of the legs dirty whitish, the fore tibia at its extremities slightly testaceous, and in some lights changing throughout to dull yellowish amber. Wings vitreous, the neuration mostly colourless, but the subcosta, great cross vein, and base of the costa in some lights slightly discoloured. Setæ whitish or greyish, dark or reddish at the joinings.

♀. Body polished, dark pitch-brown, the dorsal abdominal segments darker at the joinings. Setæ white. Legs all whitish, only faintly discoloured towards the ends of the femora. Wing-nervures more nearly colourless than in the ♂. Length of body 6–7, wing 8; set. ♂ im. about 11; ♀ im. about 6 mm.

Hab. New Hampshire, on Mount Washington (McLach. Mus.), and in May at Amherst (Mus. Comp. Zool. Cambridge, Mass.). Also West Farms, N. Y.; Worcester, Mass.; and North Carolina (in the same collections). Two examples are ticketed Washington Territory in McLach. Mus.

LEPTOPHLEBIA MEMORIALIS (renamed).

Leptophlebia || *pallipes*, ! Hag., Ann. Rep. U.S. Geolog. and Geograph. Survey of the Terr. 1873, part iii. Zool. 582 (1875).

Imago (*dried*), ♀.—Body pitch-brown; the head rather brighter and redder or chestnut-brown, but pitch-black at the orbits of the ocelli, in two depressions behind them on the vertex, and in the middle of the occipital crest; thorax rather darker at the sides; abdomen growing darker above in segs. 7–10, the first segment broadly and the others narrowly bordered with pitch-black at the tips above; the spiracular line dark, the ventral lobe of the 9th segment pale, bifid, with elliptical segments. Wings vitreous, with almost colourless neuration; the longitudinal nervures, distally, tinged faintly with very pale brownish; marginal area of the fore wing with about 8 evanescent cross veinlets before the nodal point, and about 17 (only well defined in the pterostigmatic space) beyond it, mostly simple and almost straight. Legs pale yellowish white, the femora faintly tinged with brownish distally, the fore coxa pale, the hinder coxæ pitch-brown, the first three tarsal joints faintly brown-tinted. Length of body 6, wing 7 mm.

Hab. Truckee, Nevada, in the Sierra Nevada (G. R. Crotch, in Mus. Comp. Zool. Cambridge, Mass.). With a low power, the legs in some lights seem uniformly pale brownish white. The name *pallipes* having been preoccupied by Walker in the unrestricted genus *Leptophlebia*, I have assigned another to this species, which has reference to its original captor, whose untimely death was primarily due to exposure in the course of the expedition when the insect was obtained.

LEPTOPHLEBIA DEBILIS, Walk.

‡*Baetis debilis*, ! Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 569 (1853); Hag., Smithson. Miscell. Coll. (1861), Synop. Neuropt. N. Am. 46.

The description of this "museum species" was based upon a single ♀ imago, whose generical affinities were misunderstood by Mr. Walker. In 1871 I cited it as synonymous with ‡*Palingenia concinna*, ‡*P. pallipes*, and probably with ‡*Ephemera hebes* of the same author (*i. e. Blasturus cupidus*, Say); but having re-examined the type specimen, I now believe it to be a *Leptophlebia*, not yet definitely described.

LEPTOPHLEBIA GREGALIS, sp. nov.

Subimago (*dried*).—Fore wings very light brownish grey, with the stronger nervures in opaque view dull light rufo-piceous; in some other positions their colour is that of the membrane. Hind wings whitish grey, with yellowish white neuration. Setæ light brownish grey. Legs rather paler than in the imago.

Imago (*dried*).—♂. Body reddish pitch-brown; thorax sometimes nearly pitch-black

above; abdominal joinings opaque. Setæ rusty whitish or drab, with their bases rusty Forceps-limbs light rusty-brown. Inferior spurs of the penis-lobes obliquely deflected, broadly compressed and acuminate. Legs rufescent brown, changing to rufescent amber in transmitted light; the fore tarsus, and the tibiæ and tarsi of the hinder legs, rather lighter than the remainder. Wings vitreous, with the longitudinal neuration and the opaque cross-veinlets of the pterostigmatic space of the fore wing light rufo-piceous; these are somewhat irregular and variable, sometimes sparsely branched and anastomosing, and are about 12–16 in number.

♀ very similar to the ♂. Setæ whitish. Hind tibiæ and tarsi whitish, with the extreme base of the tibia, the ungues, terminal joint, and the distal borders of the other joints of the tarsus, rufescent brownish. Wings nearly as in ♂, but the nervures posterior to the cubitus of the fore wing are practically colourless; the marginal area contains about 10 weak cross veinlets between the great cross vein and the bulla, and 17–21 (mostly stronger) beyond that; these are usually simple, and many of them tapering towards the costa are slightly curved. Length of body 8, wing, ♂ 8–9, ♀ 7–9, setæ, ♂ 14 mm.

Hab. Mount Hood, Oregon (McLach. Mus.).

Leptophlebia rufivenosa, sp. nov.

Subimago (*dried*), ♀.—Wings transparent, light yellowish brown-grey; their neuration in opaque view light ferruginous brown, changing in transmitted light to rufo-piceous. Setæ (Vandyke) brownish grey.

Imago (*dried*), ♀.—Body brownish piceous, or dark rufo-piceous, with the joinings of the abdominal segments of empty specimens opaque. Setæ somewhat lighter than in the subimago, with the joinings towards the roots, in large examples, opaque and narrowly rufo-piceous. Fore femur in opaque view intense (ferruginous) brown-ochre, the tibia and tarsus much lighter or somewhat testaceous; the leg reflects a warm ferruginous tint; in transmitted light the femur and tibia are of a ferruginous amber-colour, the trochanter and tarsus paler. Hinder legs rather lighter than the fore legs. Wings transparent, the membrane lightly and uniformly tinted, and the neuration strongly coloured with ferruginous ochre, the latter reflecting a reddish or golden brown and transmitting a rich amber-colour. The marginal area of the fore wing contains 7–8 cross veinlets before the bulla, and 17–20 beyond it; those in the pterostigmatic region are simple and slightly sinuous in small specimens, but in large examples are apt to be irregular in some degree, and to anastomose in parts with one another. Length of body, ♀ 6–8, wing 7–10, setæ im. 8–10 mm.

Hab. Mount Hood; Washington Territory (McLach. Mus.); S. Raphael, Cal. (Osten-Sacken, in Mus. Comp. Zool. Cambridge, Mass.), March 7th.

(?) Leptophlebia præpedita, sp. nov. Plate XI. 17 *c* (forceps and penis, in two positions).

Subimago (*dried*).—Wings sepia-grey, with pitch-brown neuration. Setæ sepia-brown.

Imago (*dried*), ♂.—Thorax jet-black above; abdomen pitch-brown, sometimes light

pitch-brown, with joinings 2–7 opaque; venter probably lighter than the dorsum, and more of a warm sepia-brown. Setæ warm sepia-brown. Legs pitch-brown, the fore tarsus and the hinder legs rather lighter than the fore femur. Wings vitreous, with a faint brownish grey tint; their neuration, in opaque view pitch-brown, transmits a brown amber-colour; the marginal area of the fore wing contains 3–7 indistinct cross veinlets before the bulla, and 11–14, mostly well defined, beyond it, those in the pterostigmatic region are simple and usually slightly curved. The form of the genitalia is noteworthy. Length of body 5, wing 5–6 mm.

Hab. Dedham, Mass. (McLach. Mus.). The apparent presence of a short joint next to the basis in the forceps-limbs is the sole cause of my hesitation in ranking this species in *Leptophlebia*.

I have seen specimens of several other North-American species of *Leptophlebia*, but not sufficient for their description.

BLASTURUS, Etn. 1881.

Illustrations. Adult (details) Pl. XI. 18. *Nymph* Pl. XXXIII., see also (?) *B. vespertinus*, L., below.

Adult.—Similar to *Leptophlebia* in the form and neuration of the wings, the structure of the mesothoracic spiracle, the ♂ genitalia (in the known species conformable to those of *L. marginata*), the ventral lobe of the 9th ♀ abdominal segment, the legs, and the ungues of the tarsi; differing from that genus in the proportional lengths of the caudal setæ, which vary with the species. Median seta considerably shorter than the others; outer setæ in ♂ 2–3 times as long as the body, median from $\frac{3}{5}$–1 the length of the body; outer setæ in ♀ $1\frac{1}{3}$–$1\frac{4}{5}$, median $\frac{1}{2}$–$\frac{3}{10}$ as long as the body.

Nymph (judging from its structure) latent; abdominal tracheal branchiæ diversiform, foliaceous and fringeless; those of segment 1 bifid, with minutely hairy linear-lanceolate divisions; those of the other 6 pairs reclinate upon the sides of the dorsum, and formed of jugate, obliquely subovate, tail-pointed lamellæ, whose cusps are minutely hairy at the edges, and are traversed longitudinally by the main tracheæ of the lamellæ. The following slight differences are noticeable in the outlines of these lamellæ:—in those of segments 2–6 the outer division of the twin lamella, at the base of the cusp, is incised on one side and has a sinus on the other side, while the inner division is incised on both sides of the cusp; but in those of segment 7 are no incisions. Caudal setæ defective in the specimens examined. Fangs of the mandibles in a large measure similar to those of *Leptophlebia*; the endopodite slender, somewhat abrupt, and furnished with a slender brush of hair. Palpus of maxilla I. slender; the last 2 joints together constitute little more than half of the whole. Lacinia of maxilla II. broad, nearly in the form of the quadrant of a circle. Tongue rotundly subquadrate; paraglossæ broadly rounded. Abdomen slightly dilated in the middle; hinder lateral angles of segments 8 and 9 shortly and acutely produced. Hind leg a little the longest; the tarsus (excluding the claw) $\frac{1}{2}$ as long as the tibia.

Type. B. cupidus (in *Ephemera*), Say.

Distribution. Temperate N. America, and perhaps Scandinavia.

Etymology. βλαστάνω and οὐρά, from the median caudal seta resembling one that is sprouting forth and not fully developed.

The wings of *Blasturus* figured in Pl. XI. belonged to a large specimen; in those of smaller examples the branchlets of the nervures along the terminal margin are less intricate, as a rule, and similar to those shown in the illustration of *Leptophlebia*. The nymphs were communicated to me by Dr. Hagen, and were identified generically mainly by the wing-neuration and stature of specimens of mature growth, taken into consideration with their native localities. No aid towards the discrimination of the species described is afforded by the shape of the penis in the dried insects.

Blasturus cupidus, Say. Plate XI. 18 (adult wings and legs), XXXIII. (nymph ?).

Ephemera cupida, Say, West. Quart. Rep. ii. 163 (1823); Le Conte, Complete Writings of T. Say, i. 172 (1859).—*E. Hebes*, Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 538 (1853)?.

Palingenia pallipes ! & *concinna*, ! Walk., *op. cit.* 553 (1853).

Potamanthus cupidus & *concinnus*, Hag., Smithson. Miscell. Coll. (1861), Synop. Neuropt. N. Am. 51; (*cupidus*), Walsh, Proc. Acad. Nat. Sc. Philad. (1862), 372; Hag., Proc. Ent. Soc. Philad. ii. 172 (1863).

‡ *Baëtis ignava* ! Hag., Smithson, &c. 47 (1861).

Leptophlebia cupida (part), ! Etn., Trans. Ent. Soc. London (1871), 89, pls. ii. 2*b* & iv. 29–29*b* [details].

Blasturus cupidus !, Etn., Ent. Mo. Mag. xvii. 193 (1881).—*B. concinnus*, ! *id.*, in the writing of Pl. XI.

Subimago (*dried*).—Wings light sepia-grey, with dark neuration, but with the membrane and neuration at the wing-roots and in the axillary area of the fore wing, and to a larger extent at the base of the hind wing, paler or even dull yellowish whitish, especially in the ♀. Median seta in ♂ rather more than $\frac{1}{2}$ as long as the outer setæ, and so in the ♀, but in a less degree.

Imago (*dried*).—Median seta about $\frac{1}{4}$ as long as the outer setæ in the ♂, and about $\frac{1}{3}$ in the ♀. Pterostigmatic portion of the fore wing tinged slightly with brownish in the ♂; marginal area in the ♂ with 9–15 (commonly 10) cross veinlets before the bulla and 27–33 beyond it, but in the ♀ 9–13 before and 19–23 beyond (counting along the subcosta); those in the pterostigmatic region rather irregular, somewhat curved, and sometimes forked and anastomosing near the costa.

♂. Thorax pitch-black, varied at the sides and beneath with rufo-piceous. Abdomen discoloured; dorsum pitch-brown, with narrow yellowish joinings, sometimes varied with rufo-piceous in aged cabinet specimens, often in some degree translucent in the midst; venter in segments 2–8 pale dull rufo-piceous or subtestaceous, segment 9 rufo-piceous; forceps dull yellowish brown or rufo-testaceous, sometimes darkened distally. Fore legs dark pitch-brown, the tarsi sometimes lighter; hinder legs in opaque view either light pitch-brown or (in a specimen from Milford, N.H.) dull bronze-brown, changing in transmitted light to deep amber and light yellow-amber respectively. Wing-neuration light pitch-brown, changing in transmitted light to rufous or light amber; the cross veinlets before the bulla in the marginal area of the fore wing very indistinct.

♀. Head rufescent, the vertex with a large pitch-black blotch in the midst on the occipital border, and another about the ocelli. Thorax piceous above, the pronotum

varied with slightly prominent rufescent markings. Abdomen discoloured, the venter rather redder than the dorsum. Setæ sepia-grey, annulated at the joinings with piceous, the median seta lighter than the others; the annulations of the outer setæ towards the roots, and again towards the tips, are subequal to one another in breadth, but many in the intervening portion of the seta are alternately narrow and broad. Wings vitreous, tinted very slightly throughout, and in the distal portions of the marginal and submarginal areas of the fore wing rather more perceptibly, with light yellowish-brownish; neuration pitch-brown, changing to golden brown in transmitted light, but lighter in colour in the parts corresponding with the paler regions of the subimago's wings. Fore legs pitch-brown; the hinder legs rather lighter and more nearly rufescent- or lutescent-piceous in opaque view, changing in transmitted light to rufous; in some lights the tarsi appear browner than the tibiæ, and these, in their turn, lighter than the femora.

Variety (from North Carolina).—Wings of subimago more nearly uniformly sepia-grey, and somewhat darker in tint than in normal specimens. Wings of imago clearer, and in the ♂ not tinged with brownish in the pterostigmatic region; their neuration lighter in colour.

Length of body 9–11; wing 10·5–12; setæ, ♂ im. about 30 & 7, subim. about 11 & 7; ♀ im. 17 & 6, subim. about 13 & 7 mm.

Hab. Cincinnati, Ohio (Say); Nova Scotia and (?) Newfoundland (Walker); Canada, West Farms, N. Y., and Mt. Washington, N. H. (M'Lach. Mus.); Milford, N. H., Andover, Me., and Morganton, N. C. (Hagen Mus.). The variation in colour of the N. C. examples noted above may prove to be merely due to the advanced age of individual subimagines, and premature death of imagines, respectively.

Blasturus gravastellus, sp. nov.

Subimago (*dried*).—Wings light grey, with dark neuration; the base of the hind wing and the axillary region of the fore wing very little paler than the remainder of the membrane, although the main nervures are rather pale towards the roots.

Imago (*dried*).—Median seta of ♂ about $\frac{1}{2}$ as long as the outer setæ; that of ♀ about $\frac{2}{3}$ or $\frac{3}{4}$ as long as the outer. Pterostigmatic portion of the fore wing very faintly obscured in ♂; the marginal area in ♂ contains 7–9 cross veinlets before the bulla and 19–22 beyond it, in ♀ 9–11 before and 19–24 beyond the bulla; those in the pterostigmatic space are slightly curved, and often branch irregularly in parts so as to anastomose with one another near the costa.

♂. Very similar to *B. cupidus*; pleuræ and sternum varied in a lesser degree with rufo-piceous; dorsum of abdomen more uniformly pitch-brown; venter less brightly coloured, segments 7 and 8 unicolorous, segment 9 not at all strongly contrasted in colour with those preceding it; forceps unicolorous, light testaceous; setæ sepia-grey, annulated with piceous at the joinings, the annulations narrower and less unequal in breadth than those of *B. cupidus* ♀. Fore legs in opaque view uniformly pitch-brown; hinder legs luteo-piceous, changing in transmitted light to golden brown or rich amber, with the extreme edges of their tarsal joinings faintly darker. Fore wings vitreous;

neuration in opaque view for the most part colourless, but the subcosta and radius as well as the distal portion of the costa light umber-brown, changing in transmitted light to pale brownish amber.

♀. Head as in *B. cupidus*. Thorax pitch-brown above; pronotum pitch-black in the middle, but towards the sides lighter than that of *B. cupidus*. Setæ subsimilar to those of the same species, but of a warmer tint. Wings vitreous, not tinted in the pterostigmatic space; neuration not so dark as in *B. cupidus*. Fore legs in opaque view light pitch-brown, with the trochanter and base of the tibia dull pale yellowish brown, and the tarsus more opaque than the tibia; the femur and tibia reflect a rufo-piceous tint, the tarsus a dark reddish brown: in transmitted light their prevailing colour is dark amber-brown. Hinder legs in opaque view either apparently of lighter shades of the same colours as the fore legs, or more of a light bistre-brown; their reflection is raw umber-brown; in transmitted light their colour is yellow-amber, and the tarsal joinings are narrowly opaque. Length of body 8–10; wing 8–12; setæ, im. ♂ 17 & 8–18 & 9, ♀ 12 & 9·5–17·3 & 13 mm.

Hab. Montana (McLach. Mus.). A species smaller and lighter in colour than *B. cupidus*.

Blasturus nebulosus, Walk.

Palingenia nebulosa, ! Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 554 (1853).

Potamanthus nebulosus, Hag., Smithson. Miscell. Coll. (1861), Synop. Neuropt. N. Am. 52; Walsh, Proc. Ent. Soc. Philad. ii. 193, note 13, 194, note 15 (1863).—*P. odonatus*, Walsh, Proc. Acad. Nat. Sc. Philad. (1862), 372; Hag., Proc. Ent. Soc. Philad. ii. 171 (1863).

Leptophlebia nebulosa, ! Etn., Trans. Ent. Soc. London (1871), 89, pl. v. 1–1 *a* [details].

Imago (*dried*) ♂.—Thorax jet-black above. Abdomen pitch-brown above, dull light burnt-umber brown beneath. Forceps either uniformly light umber-brownish, or very light dull yellowish ochre at the base, passing distally into light brownish. Setæ light Vandyke-brown, with pitch-brown joinings. Fore legs rufo-piceous, the tarsi lighter; hinder legs either testaceous or dull translucent, almost raw-umber brown. Wings vitreous, with rufo-piceous neuration; the fore wing with a large round light raw-umber cloud in its apical third; its marginal area with 7 faint cross veinlets before the bulla and about 22 beyond it, many of which in the pterostigmatic space fork near the costa and anastomose with one another. Length of body 10, wing 10–11, setæ 30 & 6 mm.

Hab. St. Martin's Falls, Albany river, Hudson's Bay (Brit. Mus.); Rock Island, Ill. (*Walsh*).

(?) Blasturus vespertinus, Lin.

Ephemera vespertina or [*Ephemera*], Lin., [Œlandska Resa, p. 21 (1745); Fn. Succ. ed. i. 755 (1746); Syst. ed. x. i. 547 (1758); Fn. Succ. ed. ii. 378 (1761)]; *id.*, Syst. Nat. ed. xii. pars ii. 906 (1767); [De G., Mém. pour servir à l'hist. d. Ins. ii. pars ii. 646, pl. xvii. 11–16 (1771);] Zet., Ins. Lap. col. 1045 (1840); Westw., Introd. mod. classif. Ins. ii. fig. 61, no. 19, after De Geer (1840).

Subimago (*dried*).—Body and fore wings black; hind wings white. One of the smaller species of the family.

Hab. Plentiful at the river Sathaella, in Smoland. [Abstract from Linné.] De Geer's

whole-figure of the nymph is fairly characteristic of a *Blasturus*; but that of the detached gill (fig. 13) differs from the typical tracheal branchiæ of this genus in having the slender tail-points of the laminæ in complete continuity with rest of the membrane. It is needless to detail references to Geoffroy, Fabricius, Berkenhout, Gmélin, Rossi, Schranck, Cederhjelm, Walckenaer, Latreille, and Stewart, who quote Linné's diagnosis. In 1871 I ranked *E. vespertina* with the typical species of *Leptophlebia*, citing as synonyms *Ephemera albipennis*, Retz. no. 181 (1783), and *Baëtis fusca*, Burm., Handb. der Ent. Bd. ii. Abth. ii. 800 (1839). It was cited as a *Cloë* by Oulianine in 1867.

CHOROTERPES, Etn. 1881.

Illustrations. Adult (details), Pl. XII. 19; (whole figures) see Pictet, *Potamanthus* ‡ *marginatus*, *op. cit.* pl. 25 (1843–5). *Nymph*, Pl. XXXIV.

Adult.—Hind wing in front strongly and somewhat obtusely angulated nearly midway between the tip and the wing-roots, the angle, roughly speaking, forming the vertex of an obtuse triangle whose base is the radius (3); the exterior side of the triangle is not straight, presenting a shallow sinus about the extremity of the subcosta (2), followed by a very slight salient curve; its other side is somewhat rounded off at the wing-roots; the very gently curved subcosta lies rather nearer to the costa than to the radius, and terminates obliquely in the margin a little beyond the salient angle, in the vicinage of which the narrow marginal area is slightly dilated; the submarginal area is subtriangular, with the vertex obtuse; several cross veinlets occupy the distal $\frac{1}{3}$ of the former area, and a larger number the adjoining $\frac{2}{3}$ of the latter area. Cross veinlets plentiful towards the apex of the fore wing, but sparse elsewhere; next to none present in the marginal area before the bulla; in the hind wing they are fairly numerous. The nervures of both wings are devoid of branchlets at the terminal region, and there are no isolated veinlets there. The axillar nervures (9^1 and 9^2) of the fore wing, strongly arched and mutually subparallel in the specimen figured, are often disposed in a manner similar to those of the wing represented in Pl. XIII. 20^{*2}. The anal-axillar interspace of the fore wing contains four intercalary nervures, of which 1 and 3 are long, 2 and 4 short; they are commonly abrupt and linked together by few cross veinlets; very frequently intercalar 1 is connected with the anal by several cross veinlets, and occasionally intercalar 3 establishes direct communication with the first axillar; intercalars 2 and 4 sometimes remain isolated from the others. The guard is lacking at the orifice of the mesothoracic spiracle. Forceps-limbs of ♂ 4-jointed; joints 1, 3, and 4 short, the 2nd joint long, somewhat incurved, moderately compressed, and rather broadly dilated beneath at the base; forceps-basis short and stout, slightly emarginate in the middle; the corresponding ventral lobe of ♀ obtusely rounded and entire at its extremity. Median caudal seta subequal to the others; outer setæ of ♂ about $1\frac{1}{5}$ as long as the body. Tarsal ungues dissimilar each to the other. Fore tarsus of ♂ nearly as long as the tibia, which is about $1\frac{2}{3}$ as long as the femur; the joints in diminishing sequence rank 2, 3, 4, 5, and 1; hind tarsus (exclusive of joint 1) nearly $\frac{1}{4}$ as long as the tibia and joint 1 combined; its joints rank 5, 1–3 (subequal), and 4; joint 1 is fairly defined.

Nymph latent; abdominal tracheal branchiæ diversiform; those of segment 1 single, linear-lanceolate and minutely hairy; those of the other segments imbricate lengthwise at the sides of the dorsum, and formed of jugate, foliaceous lamellæ, oblique at the base and (speaking roughly) cuspidate at the extremity; in each twin the laminæ are unequal in size and rather dissimilar in form, the smaller being obliquely ovate, the larger obliquely subcordate-ovate, with one of the auricles large; the terminal cusp of both is effectively discontinuous with the major portion of the lamina (through the membrane on each side of its base being deeply incised) and is commonly turned upon its longer axis so as to lie in a plane at right angles with that of the other portion; the cusps are wider than those of *Blasturus*, for the most part, and less prolonged. Fangs of the mandibles abrupt; the brush of the endopodite tapers obliquely to a slender point. Palpus of maxilla 1 slender; joints 2 and 3, together, slightly longer than joint 1. Laciniæ of the 2nd maxillæ rather broader, and the lobes of the labium smaller, than those of *Blasturus*. Tongue produced in the middle into an obtuse emarginate lobe, and prolonged on each side into a slender curved claw-like projection; paraglossæ acute laterally, rounded in front. Abdomen slender, the hinder lateral angles of the intermediate segments shortly and acutely produced. Caudal setæ about twice as long as the body. Hind leg a little the longest; the tarsus nearly $\frac{1}{3}$ as long as the tibia (the claw excluded).

Type. Ch. Picteti, Etn.

Distribution. Europe southwards of Belgium and Saxony; America (undescribed sp.), Arizona.

Etymology. χορός and τέρπω, delighting in the dance.

The figures of the tracheal branchiæ do not display the peculiar trending of the cusps of the laminæ, owing to their having been subjected to pressure, when drawn, in order to exhibit their outline. The species from Arizona is represented by two subimagines in Mr. M'Lachlan's collection. Identification of the nymph was accomplished by direct observation in the field.

CHOROTERPES PICTETI, Etn. Plate XII. 19 (wings, legs, forceps, and penis).

Potamanthus ‡ *marginatus*, Pict., Hist. Nat. Névropt. ii. Ephém. 208. pl. xxv. 4, 5 (1843–5); Walk., List of Neuropt. in Brit. Mus. part iii. 540 (1853); ? Oulianine, Neuropt. & Orthopt. of Prov. of Moscow, 27 (1867).

Leptophlebia Picteti, Etn., Trans. Ent. Soc. Lond. (1871), 87; ! *id., op. cit.* (1873), 395; ! Rostock, Jahresb. d. Ver. f. Naturk. Zwickau, 1877, p. 84 (1878).

Habrophlebia Picteti, ! Etn., Ent. Mo. Mag. xvii. 196 (1881) [citation].

Choroterpes [type] *lusitanica*, ! *id., op. cit.* xvi. 194 (Feb. 1881).—! *Ch. Picteti* (Etn. MS.), M'Lach., Compt.-rend. Soc. Ent. Belg. xxv. 135 (1881).

Subimago (*living*).—Wings uniformly purplish black. Legs and setæ dark piceous; tibiæ and tarsi at first reddish piceous.

Imago (*living*), ♂.—Upper portion of eyes intense warm sepia-brown. Thorax jet-black above. Abdomen pitch-black, with pale rufescent joinings; penultimate ventral segment distinctly, and a few of the segments anterior to it faintly, tinged posteriorly with rufescent; forceps-limbs rufescent interiorly and distally; penis and setæ pitch-

black. Legs pitch-black; fore tarsus scarcely paler; hinder tibiæ and tarsi rufescent-piceous, the latter somewhat darker than the former. Wings vitreous with a somewhat taleose gloss; fore wing tinged with blackish (or in the dried insect, with fuscous) in the marginal and submarginal areas; neuration piceous, the costa somewhat testaceous at the base; cross veinlets numerous in the marginal area of the fore wing, numbering about 6 before the bulla and 16 beyond it; those in the pterostigmatic region anastomose irregularly with one another. Length of body 10; wing 10; setæ, ♂ im. 12, subim. 9 & 12 mm.

Hab. Widely distributed in Europe, ranging from Belgium and Heidelberg (M'Lach.), Dresden (Herr C. Schiller), and Switzerland (Pict.), to southern Italy and Portugal. The nymph inhabits gently flowing shallow water, and attains maturity in summer and autumn.

THRAULUS, Etn. 1881.

Illustrations. Adult (details), Pl. XII. 20, and XIII. 20*, 2, 3. *Nymph*, Pl. XXXV.

Adult.—Hind wing strongly and obtusely angulated in front, the angle in normal species more nearly right-angled than in *Choroterpes*, placed almost in the middle of the fore margin, and followed directly by a well-defined sinus at the termination of the subcosta (2); marginal area oblong, truncate distally, and, after the great cross vein, of nearly uniform width; submarginal area trilateral, the radius (3) somewhat undulated in the typical species, the angles adjacent to it very acute, that subtended by it rather obtuse: in the marginal area, and in direct proximity to the salient angle, a single strong cross veinlet (or two at the most) communicates between the costa and the subcosta; in the submarginal area are 2 or 3 between the subcosta and the radius, seldom followed by a few others between the radius and the fore margin. Cross veinlets in the normal species numerous in the fore wing, excepting near the terminal and inner margins, which have no isolated veinlets; they are absent also from the marginal and submarginal areas before the bulla. The nervures of both wings in the typical species are generally branchless at the terminal margin; when any branchlets do occur, which is but seldom, they are very scanty, simple, and peculiar to the individual wing. [Deviations from the normal type of neuration are described below in the paragraph following the definition of the genus.] The anal-axillar interspace of the fore wing contains 2, 4, or 5 intercalary nervures, two of them long, the others short; when there are two only, they extend $\frac{2}{3}$ of the distance towards the wing-roots, and communicate by few cross veinlets with both of the nearest nervures; when 4 are present, the two shorter are placed as in *Choroterpes*, all communicate more or less both mutually and with the said nervures by cross veinlets, and all terminate abruptly; when there are 5, the fifth shares with another the interspace between the longest two. The orifice of the mesothoracic spiracle has valves only and lacks the guard. Forceps-limbs of ♂ 3-jointed; the proximal joint much longer than the remainder, and more or less dilated towards the base; the dilatation gradual in normal species. Forceps basis short, entire; homologous ventral lobe of ♀ obtusely rounded at its extremity. Caudal setæ 3, subequal in length to each other, mutilated in the typical specimens. Ungues in every tarsus dissimilar each to the

other; fore tarsus of ♂ subequal in length to the tibia, which is nearly twice as long as the femur; the joints in diminishing sequence rank 2, 3, 4, 5, and 1. Hind tarsus (including joint 1) nearly $\frac{1}{2}$ as long as the tibia; its joints rank 5, 2 subequal to 3, 1 and 4; the proximal joint is ill defined in dried examples. *Nymph* latent; abdominal tracheal branchiæ all bipartite; those of segment 1 with simple filiform divisions beset with short minute hairs; those of the other segments decumbent upon the sides of the dorsum, with simple oblong-ovate foliaceous divisions, fimbriate simply at the margins. Caudal setæ about as long as the body, similar to those of *Leptophlebia*. Mandibles, labium and second maxillæ, tongue and paraglossæ, very similar to those of *Choroterpes*; but the last are abrupt and emarginate, instead of acute, at the tips. Maxilla 1. also subsimilar to that of *Choroterpes*; but there is no spine below the subterminal series of pectinate setulæ on the lacinia, the palpus proportionally is rather shorter, and joints 2 and 3 together are subequal to 1 in length. Abdomen slender, slightly dilated at the sides; the hinder lateral angles of segments 8 and 9 shortly prolonged and acute. Hind leg rather the longest; the tarsus (claw excluded) about $\frac{1}{3}$ as long as the tibia.

Type. *Th. bellus*, Etn.

Distribution. Portugal; Central America (an undescribed sp.); also (provisionally referred species) Columbia and Lahat.

Etymology, θραῦλος, fragile.

The nymph of the typical species was identified, chiefly by inference from the local fauna of the stream where it was found, and partly by the structure of the genitalia of advanced specimens. The neuration of the fore wings of certain Central- and South-American species provisionally referred here (*Th. mexicanus* &c.) departs slightly from the type in the following particulars:—Cross veinlets are plentiful in proximity to the terminal margin, and the longitudinal nervures terminating in that margin are more frequently branched than in normal species. The intercalar nervures of the anal axillar interspace towards their anterior extremities curve forwards to unite each with the nervure next in advance, in the manner usual in species of *Atalophlebia*. Some of these species have cross veinlets before the bulla in the marginal area.

THRAULUS BELLUS, Etn. Plate XII. 20 (wings, legs, forceps, and penis). *Nymph*, Plate XXXV.

Thraulus bellus, ! Etn., Ent. Mo. Mag. xvii. 195 (1881).

Subimago.—Wings light blackish grey.

Imago (*living*), ♂.—Eyes intense warm sepia-brown. Body blackish piceous; thorax jet-black above, with pale sutures. Legs piceous; the fore tarsi blackish, the hinder tibiæ and tarsi lighter. Wings vitreous, with light pitch-brown neuration; the marginal area of the fore wing contains about 12 well-defined and 3–4 very indistinct straight cross veinlets in the pterostigmatic region, but none before the bulla. Length of body, ♂ 8, ♀ 7 mm.

Hab. Portugal, in the stream below Cintra. The nymph was discovered at the end of April 1880. To find the imago, I revisited the locality on the 1st of June, early in the

morning (8–10 A.M.) before the sea-breeze arose. The only specimens of the adult and subimago obtained were struggling in a spider's web.

THRAULUS SIGNATUS, Hag.

Cloë signata, ! Hag., Verh. zool.-bot. Gesells. Wien, viii. 477 (1858), & ix. 206 (1859); [Gen. ——?], Etn., Trans. Ent. Soc. London (1871), 131, note.

Leptophlebia (Etn.) *signata*, Hag., *op. cit.* (1873), 395.

Subimago (*dried*).—Wings taleose, transparent, dark sepia-grey, with concolorous neuration. Setæ of a like colour, with dark joinings. Thorax dull pitch-brown; legs of duller colour than those of the imago.

Imago (*dried*).— ♂. Thorax polished, bright pitch-brown or rufo-piceous; dorsum of abdomen purplish sepia-brown; segments 2–6 translucent, paler at the base and sides, but opaque at the joinings, and blackish at the stigmata; venter subochraceous with darker joinings, excepting the ninth joint and the inwardly dilated base of the forceps, which are somewhat rubiginose; setæ light sepia-grey, with blackish joinings. Wings transparent colourless, iridescent; their longitudinal nervures translucent, very faintly tinged with pale brownish or amber colour, the wing-roots piceous; about 5 simple nearly straight cross veinlets in the pterostigmatic space of the fore wing. Fore legs lost; femora and tibiæ of the hinder legs the palest Vandyke-grey, the former banded in the middle and at its extremity with black, the tarsus and ungues faintly tinged with testaceous.

♀ very similar but darker; the ventral joinings of the abdomen more widely opaque; the pterostigmatic space of the fore wing sometimes contains 7 simple nearly straight cross veinlets. Length of body 5; wing, ♂ 6, ♀ 7; setæ, ♂ and ♀ im. about 6 mm.

Hab. Rainbodde, Ceylon, at altitudes of upwards of 4000 feet (Hag. Mus.). I do not think that the dilated portion of the base of the forceps is a separate joint.

With the types of *Thraulus signatus* stood single examples of two other species, perhaps of the same genus, from the same locality, numbered respectively 32 and 37.

Compared with *Thraulus signatus*, no. 32 presents the following differences:—none of the femora have a median black band, but only the terminal band; the dimensions of the insects in length of wing and body being the same, the legs of 32 are proportionally longer, and their colour generally is more flavescent; the wings have a stronger neuration, the longitudinal nervures are distinctly browner; in the pterostigmatic space are 10 simple and straight cross veinlets, of which the four nearest to the bulla are very faint.

No. 37 has the hinder legs uniformly pallid (fore legs lost), and 5 simple straight, or nearly straight, cross veinlets in the pterostigmatic space finer than those of *Th. signatus*.

THRAULUS EXIGUUS, sp. nov. Plate XIII. 20*[2] (forceps, penis, wings, and hinder foot).

Imago (*dried*), ♂.—Thorax above luteo-piceous. Abdomen discoloured, fuscescent. Hinder legs whitish, with femora banded very broadly with black in the middle, the extremities of the femora and bases of the tibiæ also blackish, and the tarsi somewhat

amber-coloured or subtestaceous. Wings vitreous, with light pitch-brown nervures; the marginal area of the fore wing contains about 11 simple and straight cross veinlets in the pterostigmatic region, but none before the bulla. Length of body 6, wing 6·5 mm.

Hab. Lahat, Palenburg, viii. 22. Communicated from Leyden by Mr. Ritsema.

Thraulus mexicanus, sp. nov. Plate XIII. 23*[4] (hind wing and genitalia).

Calliarcys (provisional) *mexicanus*, ! Etn., in the writing of the plate quoted.

Imago (*dried*), ♂.—Thorax fuscous above. Abdomen white, with segments 8–10 and the apical margins of segments 2–7 fuscous. Setæ white with black joinings. Fore wings vitreous; 10 slightly curved and mostly simple (rarely anastomosing near the costa) cross veinlets exclusively in the pterostigmatic portion of the marginal area of the fore wing. Length of body 6, wing 7, setæ 15 mm.

Hab. Mexico (Brussels Mus.). The neuration of the fore wing conforms to the type of the following species.

Thraulus, sp. ——. Plate XIII.*[2] (wings).

Calliarcys (provisional) *sp.* ——, ! Etn., in the writing of the plate quoted

A nameless species represented by two ♀ subim. (M'Lach. Mus.), communicated by Messrs. Godman & Salvin, has well-defined cross veinlets in the marginal area of the fore wing both before and beyond the bulla.

Hab. Irazu, Costa Rica, at an altitude of 6000–7000 feet (H. Rogers).

Thraulus lepidus, sp. nov.

Imago (*dried*), ♂.—Thorax rich brown-ochreous above, changing in some lights to raw-umber brown. Abdominal segments 2–6 transparent whitish, each with the tip and an oblique stripe on each side recurrent therefrom, fuscescent; segments 7–10 rich brown-ochre, lighter or pale yellowish ochreous towards the sides and beneath, and narrowly edged with black at their distal dorsal border. Forceps light dull yellowish; the limbs inserted rather near to one another upon the basis, whose lower edge is only slightly prominent in the middle; the upper distal margin of the forceps-basis is prolonged into a prominent rounded lamina about half the length of the penis: penis hidden by dirt in the type specimen. Setæ white, with some of the joinings nearest the roots piceous, and others in the remainder of the seta black, viz. towards the base of the seta every alternate joining, about the middle of the seta every third joining, and beyond the middle of the same every fourth joining. Fore leg in opaque view, with the femur, tibia, and joints 3 and 4 of the tarsus pitch-brown, the remainder of the tarsus dull light yellowish ochreous, the tip of the tibia slightly tinged with pitch-black. Hinder legs in opaque view, with the femur light reddish brown or rufo-piceous, the tibia and tarsus opaque amber-yellowish. In transmitted light the dark portions of the legs are translucent rufo-piceous, the lighter portions translucent yellow-amber. Wings vitreous, their neuration and the submarginal area of the fore wing varying in colour with change of light from pitch-brown to raw-umber brown; the cross veinlets interjacent between the costa and the first half of the

pobrachial nervure, and the nearest to the wing-roots of those posterior to it in the fore wing, are slightly thickened; the submarginal area of the same wing for a short space beyond the bulla is somewhat deficient in colour; the said area contains about 4 cross veinlets before the bulla, and 14 beyond it, which are mostly straight and simple, only one or two of them forking near the costa. Length of body 7, wing 8, setæ 17 mm.

Hab. Chiriqui, Panama (M'Lach. Mus.). The neuration of the fore wing is of the same type as that of the wings represented in Pl. XIII. 23*2 and 23*3.

Thraulus colombiæ, Walk. Plate XIII. 20*3 (hind wing).

‡ *Ephemera colombiæ*, ! Walk., List of Neuropt. in Brit. Mus. part iii. 537 (1853).
Palingenia colombiæ, Hag. MS., Smithson. Miscell. Coll. (1861), Synop. Neuropt. N. Am. 304 [list].
Leptophlebia colombiæ, ! Etn., Trans. Ent. Soc. London (1871), 84.
Adenophlebia colombiæ, ! Etn., Ent. Mo. Mag. xvii. 194 (1881).

Subimago (*dried*), ♀.—Thorax very light brown-ochreous above. Abdomen light rufo-luteous above; segments 1–8 bordered with black at the apical margin, segments 2–7 marked on each side with a broad black stripe descending obliquely from the distal border. Setæ intense warm sepia-brown, dark at the joinings and in the midst of the joints. Fore femur lutescent reddish-brown, almost light clove-brown, the tibia pitch-brown, the tarsus lighter or more lutescent than the tibia; hinder legs dull, subluteous or dark testaceous, the coxæ and trochanters paler. Wings transparent light brown-ochreous-grey; in the fore wing, the longitudinal nervures, the cross veinlets in advance of the radius, and most of those posterior to it in the proximal half of the disk of the wing, are light brown-ochreous; the cross veinlets posterior to the radius in the remaining portion of the disk are black. In the marginal area of the fore wing are 1 or 2 very faint cross veinlets before the bulla, and beyond it 18–19 oblique, curved, and near the costa sparingly forked. Length of body, ♀, 10, wing 15, setæ 19 mm.

Hab. United States of Colombia (Brit. Mus.). The length of the setæ and habitat were misstated by me in 1871.

Thraulus lætus, sp. nov. Plate XIII. 23*3 (wing [part] genitalia and hinder foot).

Calliarcys (provisional) *lætus*, ! Etn., in the writing of the plate quoted.

Imago (*dried*), ♂.—Thorax rich brown-ochre above. Abdomen in segments 2–6 white, with a series of small triangular spots on each side of the dorsum, and with the spiracles black; segments 7–10, above fusco-rufescent, the 8th narrowly edged in the midst of its distal margin with light yellow ochre, the bordering enlarged abruptly on each side into a triangular spot, whose point reaches the base of segment 7; segments 9 and 10 have a small oblong yellow-ochreous spot on each side of the dorsum and a black dash at the lateral border. Beneath, segments 7–10 are light yellow-ochreous, with their lateral borders rufescent, the tips of the forceps also rufescent; ventral ganglia light warm sepia brown. Femora whitish, with a grey-black band before the middle and a very broad conspicuous rufescent band near the tip: tibiæ and tarsi in some lights very pale pitch-brown, in other lights very pale lutescent, the former grey-black at the tip, and the

latter narrowly edged with grey-black at the joinings. Wings vitreous, their nervures in opaque view testaceous, changing in transmitted light to yellowish amber-colour, their membrane slightly fuscescent by the wing-roots and great cross vein; the marginal area of the fore wing contains about 9 simple curved cross veinlets, exclusively in the pterostigmatic region. Length of body 6, wing 8 mm.

Hab. New Granada (McLach. Mus.).

ADENOPHLEBIA, Etn., 1881.

Illustrations.—*Adult* (details), Plate XIII. 21.

Adult.—Hind wing obtusely and very strongly angulated in front; the angle placed at about the first $\frac{1}{3}$ of the wing's length, and followed by a wide sinus; the sinus, extended as far as the extremity of the radius (3) and close to the tip of the wing, is nearly straight-edged from the angle to the termination of the subcosta (2), where it attains its greatest depth, and from thence to the end of the radius its margin is very gently convex; marginal area obtusely subtriangular, with the angle at the extremity of the subcosta very acute; submarginal area much narrower than the preceding, elongated, irregularly quadrangular, acuminate at both ends, and with the hinder of the obtuse angles situated nearly midway between the wing-roots and the tip of the wing; the lines containing this angle [viz. the radius, and the common trunk of the radius and cubitus (5)] are gently arched; the marginal area contains 2–4 cross veinlets, the submarginal a few more; the nearest of those to the wing-roots is in immediate proximity to the salient angle of the front margin. Cross veinlets plentiful in the fore wing, excepting towards the inner margin; most of the nervures at the terminal margin have curved simple branchlets. The arrangements of the intercalar nervures of the anal axillar interspace of the fore wing cannot be described fully through lack of an adequate series of specimens; in the wing figured they are 4 in number, and (counting from front to rear) 1 and 3 are long, 2 and 3 annex themselves to 1, and this to the anal, 4 is isolated and short; sometimes 1 and 3 project abruptly a little in front of the cross veinlets adjacent to their terminations, while 4 is much abbreviated; cross veinlets continue to be plentiful as far as the first intercalary nervure, and then become scarce. Probably other combinations occur similar in general plan to those displayed in figs. 23*^{2} and 23*^{3} of the same plate. Orifice of the mesothoracic spiracle furnished with a small oval guard. Forceps-limbs 2-jointed in the type; the proximal joint compressed, many times longer than the other, and in its basal half broadly dilated. Forceps-basis short and entire; the homologous ventral lobe of ♀ obtuse and entire. Median caudal seta subequal to the others; those in ♂ about twice as long as the body. Tarsal ungues uniformly narrow and hooked; fore tarsus of ♂ scarcely longer than the tibia, which is little longer than the femur; its joints in diminishing sequence rank 2, 3, 4, 5, and 1. Intermediate leg little more than half as long as the hind leg. Hind tarsus (excluding joint 1) about $\frac{1}{3}$ as long as the tibia and joint 1 together; its joints rank 2, 3 subequal to 5, 4; joint 1 is ill defined. *Nymph* unknown.

Type. A. dislocans (in *Ephemera*), Walker.

Distribution. South Africa.

Etymology. ἄδην and φλέβιον, from the abundance of cross veinlets in the wings.

ADENOPHLEBIA DISLOCANS, Walker. Plate XIII. 21 (wings, legs, forceps, and penis).

‡*Ephemera dislocans*, ! Walk., Trans. Ent. Soc. London, N.S. v. 198 (1860).

Leptophlebia dislocans [♀ im.], and *auriculata* [♂ im.], ! Etn., *op. cit.* (1871), 83, pl. iv. 24–24*b* [details].

Adenophlebia dislocans, ! Etn., Ent. Mo. Mag. xvii. 194 (1881).

Imago (*dried*).— ♂. Thorax above black. Abdomen light pitch-brown, the dorsal joinings opaque, the darker colour produced obliquely downwards and forwards at the sides of the segments. Setæ in some lights pitch-black, changing to intense sepia-brown in others. Fore legs in opaque view either pitch-brown or rufo-piceous, in oblique view either very intense opaque raw-umber brown, or reddish brown, and in transmitted light either translucent dark brownish amber or rufescent amber; hinder legs rufo-piceous in opaque view; femora each with a dark submedian band, and with the extreme tip dark. Wings vitreous, the hind wings posterior to the subcosta (2) tinged with piceous-grey; neuration piceous, becoming blacker or browner when the posture is varied; cross veinlets strongly defined in the marginal and submarginal areas of the fore wing; in the former area are about 6 cross veinlets before and 10 beyond the bulla; those in the pterostigmatic region are simple and slightly curved.

♀. Thorax piceous above. Abdomen discoloured; the apical borders of the intermediate dorsal segments piceous or blackish, the dark colouring produced forwards into a pair of oblique triangular streaks on both sides of the back of each (viz. a streak at the postero-lateral angle, and another between that and the median line), so arranged that each streak of the inner series is continuous with a streak of the outer series in the antecedent segment. Setæ piceous at the base and intense sepia or warm sepia-brown towards their extremities. Femora luteo-piceous, banded nearly in the middle with black, and pitch-brown at the extremity; tibiæ and tarsi rufo-piceous. Wings vitreous, their neuration in opaque view piceous, in transmitted light browner; cross veinlets of the fore wing (excepting those adjacent to the terminal margin, and those in the extremity of the pterostigmatic space) bordered with Vandyke-brown or dark warm sepia-brown, which gives rise to small irregular spots in the midst of the wing between the base and the middle, and to rounded spots just behind the radius (3) and in some other situations; at the base of the costa a spot of a like colour occupies the space between the wing-roots and the cross veinlet nearest to the great cross vein: in the marginal area are about 7 cross veinlets before the bulla, and 15, mostly simple oblique and straight, beyond it. The cross veinlets of the hind wings are narrowly bordered, and the membrane distally is tinged with light reddish brown-grey. Length of body, ♂ 9; wing, ♂ 9, ♀ 6; setæ, ♂ 20, ♀ 18 mm.

Hab. Cape Colony, Graham's Town. As the hind wings of the ♀ (in Brit. Mus.) are exactly like those of the ♂ (in M'Lach. Mus.), I referred both to a single species in 1881. Sexual differences in the marking (and even the neuration) of the wings, are met with in some other *Ephemeridæ*, notably in *Cloëon dipterum* and (coloration only) in *Hagenulus*.

HAGENULUS, Etn., 1882.

Illustrations.—Adult (details). Plate XV. 21 bis.

Adult.—Hind wing angulated in front very strongly indeed, almost midway between the wing-roots and the tip; the angle, acuminate (and in the typical species prolonged more or less into a slender projection turned over sideways as a hook), precedes directly a very deep sinus which extends far beyond the termination of the radius, and attains its greatest depth in the interval between the subcosta (2) and the radius (3) at about $\frac{1}{3}$ of the shortest distance between the apex of the wing and the costa; marginal area subtriangular, with the angle at the extremity of the subcosta obtuse; submarginal area narrower than the preceding, somewhat obcuneate, but not quite rectilinear, the subcosta being strong and straight, the radius fine and subsinuous, and the margin between them concave; posterior to the radius two longitudinal nervures meet the margin, one a little before the obtuse apex, the other at the apex of the wing; cross veinlets limited almost to a single dislocated series extending transversely from the extremity of the subcosta to the middle of the inner margin, the marginal area containing none. In the fore wing cross veinlets are plentiful as far back as the second of the intercalaries in the anal-axillar interspace, and some of them at the terminal margin constitute simple branchlets to a few of the longitudinal nervures; the intercalary nervures in the interspace mentioned are 2 in number and long; the foremost (the longer) is prone to annex itself to the first axillar. Forceps-limbs of ♂ 3-jointed, with the proximal joint longer than the remainder, compressed and broadly dilated towards the base. Forceps-basis entire; the homologous ventral lobe of ♀ bifid and acutely excised. An egg-valve of extraordinary dimensions is produced from the apical border of segment 7, broad at the base, narrowed ellipsoidally from thence to the middle, and terminating in a spout or a tube split open along its upper side, resembling an ovipositor, projecting a little beyond the extremity of segment 10. Caudal setæ 3, subequal to one another, and in ♀ about twice as long as the body. Tarsal ungues all dissimilar each to the other; fore tarsus ♂ subequal in length to the tibia, which is more than twice as long as the femur; its joints in diminishing sequence rank 2, 3, 4, 5, and 1. Fore tarsus ♀ less than $\frac{1}{3}$ as long as the tibia, which is nearly $1\frac{1}{2}$ as long as the femur; hind tarsus ♀ (excluding joint 1) little more than $\frac{1}{5}$ as long as the tibia and joint 1 (which is ill defined) together; their joints rank 5, 2 subequal to 3, 1 and 4. *Nymph* unknown.

Type. H. caligatus, Hag. MS.

Distribution. Cuba.

Etymology. Dr. H. A. Hagen, the eminent neuropterist.

HAGENULUS CALIGATUS, Hag. MS. Plate XV. 21 bis (wings, legs, forceps, and penis).

Hagenulus (in *Potamanthus*, Hag.) *caligatus*, ! Hag. MS., Etn. Ent. Mo. Mag. xviii. 207 (1882, Feb.).

Subimago (dried), ♂.—Wings transparent light bistre-grey; neuration slightly opaque, most of the discal cross veinlets of the fore wing faintly bordered with greyish, some in the first three areas marked with black; 7 cross veinlets in the marginal area before the bulla. Setæ annulated with black.

Imago [*teste* Gundlach, has in life olive-brown oculi, and a light brown-ochreous body, with a small black or brown spot on each side of every abdominal segment, Hag. MS.], ♀ (*dried*). Thorax luteo-fuscous above; abdomen discoloured, the segments darker at the tips, the venter paler than the dorsum. Setæ white, or greyish white, with black bands and joinings, the bands being placed at every joint near the base of the seta, then at every alternate joint, and ultimately, still farther away from the base, at every third joint. Wings vitreous; the marginal area of the fore wing, slightly discoloured from the base to at least as far as the middle, contains about 7 simple cross veinlets before, and 11 beyond the nodal point; neuration piceous, nearly every cross veinlet marked with a roundish blackened spot. Legs dull pale lutescent, each with two piceous bands on the femur, the tibia black at the tip, and the tarsus sublutescent [" with darker tip to the tarsus," Gundlach, MS.]. Length of body 5–7·5, wing 7·5–8, setæ about 10 mm.

Hab. Rangel Mountains, Cuba, in June (Hag. Mus.). Four ♀ imagines in the collection differ from the ♂ subim. above described in having 0 cross veinlets in the marginal area before, but 9 beyond, the bulla. Their wings are spotless, and their thorax, seemingly, is piceous above. They may represent another species.

HABROPHLEBIA, Etn., 1881.

Illustrations.—*Adult* (details), Pl. XIII. 22 *a*, *b*, & LXIV.[2] (whole figures); consult Pictet, *op. cit.* under *Potamanthus*, pls. 27 & 28 (1843–5). *Nymph*, Pl. XXXVI.; also Pictet, *loc. cit.*, and Vayssière under *H. fusca* (1882) [who both omit the tracheal branchiæ of the firsta bdominal segment].

Adult.—Hind wing angulated strongly and rather obtusely in front, nearly midway between the wing-roots and the tip; the angle, almost right-angled, is followed abruptly by a strong sinus, the margin retiring perpendicularly from the vertex of the costal protuberance, usually to about halfway towards the subcosta, and thence following a semielliptical curve round the apex of the wing; the subcosta (2), arising in a gradual curve from the wing-roots, diverges from the common trunk of the radius (3) and cubitus (5), and then with diminished curvature, running subparallel with the radius, usually passes obliquely into the margin shortly before the tip of the wing; the radius terminates quite in the extremity of the wing; hence, distally, the marginal area is usually acuminately prolonged in proximity to the subcosta, and the submarginal is semi-parabolic; but sometimes, in individual examples of certain species, the hind wing conforms essentially to that of *Thraulus* (Pl. XII. 20), the subcosta meeting and terminating in the margin at the sinus, and the marginal area being correspondingly truncate distally. Cross veinlets variable in number and distribution in both wings; in small specimens they are commonly placed as in Pl. XIII. 22 *a*, not approaching the terminal margins of the wings, and amounting to a very limited number in the hind wing; in the ♀ fore wing they are sometimes well defined in the marginal area before the bulla, where in small specimens they are usually obsolescent; in large examples they are often nearly as numerous in both wings as in *Calliarcys* (Pl. XIV. 23), and then those forming branchlets to the longitudinal nervures at the terminal margin of the fore wing are somewhat deficient in regularity, and are usually curved. The anal-axillar interspace of the fore

wing contains from 2 to 5 intercalar nervures; when there are five, 1, 3, and 4 are abbreviated or obsolescent; when four are present, intercalar 3 is absent; when there are three, 1 is the short one: intercalars 2 and 5 are constant, they communicate by cross veinlets with each other, and usually with the anal (seldom the first axillar) nervure, and either of them may terminate abruptly or else (combining intimately with a cross veinlet) may bend suddenly aside to join an adjacent nervure; for example, intercalar 5 may be isolated, or may bend suddenly aside to intercalar 2 or to the anal; and intercalar 2 may be abrupt and communicate by cross veinlets with the anal nervure alone, or may bend suddenly aside to join either the anal or intercalar 5. Orifice of the mesothoracic spiracle usually closed in the dead insect; when open, the aperture is small, gaping in front, and without a guard. Forceps-limbs of ♂ 3-jointed, the proximal joint shorter than the others combined, and suddenly dilated or tuberculated on the inner side of the base; the second and third joints rather long, and like those of a finger. Forceps-basis bifid, narrowly or acutely excised in the middle; the homologous lobe of ♀ also bifid and acutely excised. Caudal setæ in both sexes 3, mutually subequal, and thrice as long as the body. Ungues in every tarsus dissimilar each to the other; fore tarsus in ♂ little longer than the tibia, which is nearly $\frac{1}{3}$ longer than the femur; its joints in diminishing order rank 2 subequal to 3; 4, 5, and 1. Hind tarsus about $\frac{1}{4}$ as long as the tibia; its joints rank 5, 2, 3, and 4; 1 is ill defined; hind leg not much longer than the intermediate leg. Fore tarsus ♀ (exclusive of joint 1) about $\frac{3}{5}$ as long as the tibia and joint 1 combined, which are about $1\frac{1}{4}$ as long as the femur; its joints rank as in the ♂ hind tarsus; 1 is indistinctly defined. *Nymph* latent in places where the current of shallow streams is gentle, or where the ripple from rapids is greatly diminished amongst stones at the brink. Abdominal tracheal branchiæ nearly uniform in shape, bifid, with the divisions filiformly dissected, and each with fewer segments in the upper division than in the lower; when extended they slant backwards and outwards, with the smaller divisions ascending; their segments vary in number with the age of the nymph, and are most numerous in the intermediate pairs; their surface is sparsely beset with minute hairs. Mandibles, labium, and maxillæ II. very similar to those of *Blasturus*; maxillæ I. nearly as in *Thraulus*. Tongue obcordate-oblong; paraglossæ narrow, curved, oblique and acuminate laterally, with a slight indentation in the margin a little before the point. Body slender; antennæ of moderate length; posterior lateral angles of segments 8 and 9 of the abdomen shortly and acutely produced; caudal setæ about $\frac{5}{6}$ as long as the body, and beset with minute spreading hairs at the joinings. Hind leg about as long as the fore leg; the tarsus (claw excluded) almost $\frac{1}{2}$ as long as the tibia.

Type. *H. fusca* (in *Ephemera*), Curt.

Distribution. Europe, temperate and southern; N. America, New Hampshire (undescribed sp.).

Etymology. ἁβρός and φλέβιον, in reference to the prevailing delicacy of the cross veinlets of the wings.

The figures in Pl. XIII. of this volume do not display the mutual dissimilarity of the tarsal ungues; they were drawn from dried specimens. This feature of the ungues was stated correctly in Trans. Ent. Soc. London (1871), p. 90, but not in Ent. Mo. Mag.

(1881), p. 195. I have seen living nymphs of *H. fusca* and *lauta*, besides other species in Portugal and Italy.

Owing to the colours being transparent, those of the legs, wing-nervures, &c., are liable to vary greatly with the direction in which they are viewed; and as the species of this genus are in a large measure distinguishable from each other by slight differences in the colouring of these parts, it is well to state what is the position of the specimen when such and such colours appear. The following terms are employed for this purpose:—*opaque view*, when the examiner standing back to light holds the specimen directly away from the light; *oblique view* or *reflection*, when the object held towards a dark back-ground is examined under an oblique light, the examiner either facing the light with the specimen below the eye, or standing sideways to the light with the object nearly on a level with the eye; in *transmitted light* the insect is interposed between the eye and the window.

Habrophlebia fusca, Curtis. Plate XIII. 22 *a* (wings, ♂ legs, forceps, and penis).

Ephemera fusca, Curt., Lond. & Edinb. Phil. Mag. ser. 3 (1834), 120.—*E. minor*, ! Steph., Ill. Brit. Ent. vi. 60 (1835).

‡ *Baëtis cingulata*, ! Steph., *op. cit.* vi. 67 (1835).

Potamanthus brunneus, Pict., Hist. Nat. Névropt. ii. Ephém. 217, pl. xxvii. (1843–5); Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 542 (1853).—*P. fuscus*, Pict., Hist. &c. 235 (1843–5); Walk., List &c. 543 (1853); Hag., Ent. Ann. (1863), 19.—*P. minor*, Pict., Hist. &c. 237 (1843–5); Walk., List &c. 546 (1853).

Cloë cingulata, Pict., Hist. &c. 271 (1843–5).

Cloëon cingulata, Walk., List &c. 578 (1853).

Leptophlebia fusca, ! Etn., Ent. Mo. Mag. v. 87 (1868); *id.*, Trans. Ent. Soc. London (1871), 90, pls. ii. 2 *c*, v. 2–2 *b* [details]; Meyer-Dür, Bull. Soc. Ent. Suisse, iv. 318 (1874); ! Vayssière, Ann. des Sc. Nat. (6), Zool. xiii., pl. i. 1, 2 (1882).

Habrophlebia [type] *fusca*, ! Etn., Ent. Mo. Mag. xvii. 196 (1881) [citation].

Subimago (*living*).—Wings light blackish grey, the nervures, at first opaque whitish, becoming tinged with pitch-brown. Thorax pitch-brown, with pale sutures. Fore femur dull pitch-brown or pitch-black; tibia and tarsus in opaque view blackish grey, changing in some lights to warm sepia-grey. Hinder femora dull light greenish Vandyke-grey or greenish sepia-grey, tibiæ light sepia-grey, tarsi light blackish grey. Setæ light warm sepia-grey, the joinings slightly opaque. Upper portion of eyes dull reddish-brown, polished; lower part intense sepia-black.

Imago (*living*).—♂. Upper portion of oculi intense burnt-umber brown, the lower blackish. Thorax jet-black or pitch-black above, with light reddish-brown tegulæ. Abdomen pitch-brown, growing darker with age; segments 2–7 translucent, excepting at the joinings, and narrowly whitish at the base; the remaining segments opaque, the extreme distal edges of 7–9 often orange or light yellow above; venter dark sepia-grey or blackish grey, often modified to some extent in segments 8 and 9 with dull orange. Setæ light sepia-grey, with light brownish joinings. Last two joints of the forceps-limbs light sepia-grey; penis during life somewhat Y-shaped, with slender recumbent spurs beneath the lobes. Fore femur and both ends of the tibia pitch-black, the intermediate

portion of the latter pitch-brown, the tarsus lighter, varying with change of posture to brownish-black-grey: [*when dried*, in oblique view the tibia reflects a light madder-brown, or (in specimens from Biron) a light Venetian-red, and the tarsus is light testaceous; in transmitted light the former becomes translucent rufo-piceous or amber-brown, and the tarsus yellowish amber.] Hinder legs (*dried*) translucent amber-brown in transmitted light, changing in opaque view to a nearly uniform light pitch-brown, and in oblique view to a light translucent bronze or bistre-brown, the tarsi in certain positions appearing light greyish, with opaque edges to the intermediate joints, but usually concolorous with the tibiæ. Wings vitreous; the longitudinal nervures and the cross veinlets of the pterostigmatic region of the fore wing in opaque view pitch-brown, in oblique view light brownish; in transmitted light the stronger nervures become yellowish amber, and the finer whitish. The marginal area of the fore wing contains about 4 obsolescent cross veinlets before the bulla, and beyond that 11; of these, 4–8 in the pterostigmatic region are well defined, simple, and slightly curved; the remaining cross veinlets of the wing are more delicate, and are deficient in colouring, excepting sometimes those in the distal half of the submarginal area.

♀ similar generally to ♂, with the fore tarsus lighter, and the setæ with darker joinings. In the fore wing the neuration, on the whole, in a slight but appreciable degree is better defined than in the ♂, and the cross veinlets in the outer half of the wing situated between the radius (3) and the præbrachial (6) nervures exhibit the same colours as those in the pterostigmatic region. Length of body 5–7; wing 6–7; setæ, ♂ im. 8 & 12–11 & 12, ♀ 6 & 8–8 & 9, subim. 5·5 & 7 millim.

Hab. Generally common in Western Europe during the summer months, frequenting brooks and rivers of moderate temperature, and ranging from Great Britain and the Vosges (M'Lach.) southwards to the lowlands of Switzerland and southern France. Specimens from this last district (where I have met with it in the neighbourhood of Toulouse and abundantly at Biron near Orthéz) have the wings of the subimago more of a sepia-grey than a black-grey, and the legs of the ♂ imago rather brighter in tint than those of normal examples; the thorax also of a ♀ im. from Toulouse, in my collection, is pitch-brown instead of pitch-black; but this ♀ may have been prematurely killed, and the differences in colouring of the ♂ im. and the subim., mentioned, are not sufficiently marked to be accounted specific.

HABROPHLEBIA NERVULOSA, sp. nov.

Subimago (*dried*).—Wings sepia-grey, with pitch-brown neuration. Setæ warm sepia-grey, with opaque joinings.

Imago (*living and dried*).—Difficult to distinguish from *H. fusca* without actual comparison of specimens; chiefly characterized by the cross veinlets of the wings being usually more strongly defined than in that species, and by the hinder femora being dark at the tip in opaque view.—♂. Upper portion of eyes castaneo-piceous, the lower subpiceous. Thorax jet-black above, sometimes dark piceous when dried. Abdomen dark piceous above, with the apical margins of the segments narrowly yellowish, and with the bases of segments 4–7 in some examples partially translucent; venter slightly paler and

duller. Setæ either piceous, or with their bases piceous and their remainder whitish warm sepia, with the joinings alternately broadly and narrowly piceous. Forceps piceous at the base, with their last two joints smoky grey. Fore legs (*during life*) pitch-black, with brownish-black tarsi, these changing in some lights to smoky grey; hinder legs piceous, with the tips of the femora dark, the tarsi blackish grey, and the tibiæ in some lights smoky grey, excepting towards both of their extremities. *When dried*, the fore legs become dark piceous in opaque view, changing in oblique view to intense pitch-brown, with the tarsus lighter brownish or almost light burnt-umber brown; and viewed with light transmitted the femur is dark piceous amber, the tibia less opaque, and the tarsus testaceous amber. The hinder legs, *when dried*, are raw-umber brown, with the tips of the femora dark, changing in transmitted light to translucent yellowish amber, with the tips opaque. Wings vitreous, with pitch-brown neuration; cross veinlets generally well defined, excepting in the marginal area of the fore wing before the pterostigmatic region, in the submarginal area before the bulla, and in the adjacent portion of the following area; but some of the lowland specimens have those in the remaining portions of the fore wing scarcely stronger than the weaker cross veinlets of the average wing. The marginal area of the fore wing contains about 4–6 ill-defined or obsolescent cross veinlets before the bulla, 3–4 beyond it, also obsolescent between that and the pterostigmatic space, while this contains 7–12 well-defined simple straight or slightly curved cross veinlets.

♀ (*dried*).—Thorax pitch-brown above. Wings transparent, with a slight brownish-grey tint, and with the neuration more strongly defined than in the ♂. In one of the specimens all of the cross veinlets of the fore wing are very distinct; in other specimens those corresponding in position with such as are obsolescent in the ♂ are weaker than the remainder: the marginal area contains about 5–6 before the bulla, and 14–17 beyond it, which are nearly all simple. Length of body 7–8; wing 7–9; setæ, ♂ im. 8 & 8·5–9·5 & 10·5, ♀ 8 & 9·5 millim.

Hab. Common in Algarve and Portugal, in May and June; ranging from altitudes of 200–400 ft. near Silves, up to 2000–2850 ft. on Foia in the former, and in the latter from 380–1280 ft. at Cintra and 640 ft. at Ponte de Morcellos, up to 1800 ft. in the Estrella, and 1600–2500 ft. near Villa Real in Traz-os-Montes.

Habrophlebia modesta, Hagen. Plate XIII. 22 *b* (penis, two views).

Potamanthus modestus, ! Hag., Ann. Soc. Ent. Fr. sér. 4, iv. 39 (1864).
Leptophlebia modesta, ! Etn., Trans. Ent. Soc. London (1871), 91, pl. v. 3–3 *b* [details].

Subimago (*dried*).—Fore wings sepia-grey, lighter than those of *H. nervulosa*, with opaque neuration; hind wings dull pale yellowish grey. Setæ light warm sepia-brown, with opaque joinings.

Imago (*dried*), ♂.—Very similar to *H. nervulosa*, but larger; not so distinctly pale at the joinings of the abdominal segments, but on the contrary uniformly dark above, in the majority of specimens. Legs nearly of the same colours as those of *H. nervulosa*, but in most lights the fore tarsus appears concolorous with the remainder of the leg:

again, the hinder femora are just perceptibly lighter in tint than those of the species referred to, and the dark colour at their extremities is more narrowly restricted to the knee. In transmitted light the legs of *H. modesta* appear more translucent than those of *H. nervulosa*. In the marginal area of the fore wing (counting along the subcosta) are 4–6 obsolescent cross veinlets before the nodus, and beyond that 3–4 obsolescent followed by 11–16 well defined in the pterostigmatic region; of these last many are simple and straight or curved, but in many specimens some amount of irregularity is noticeable in the veinlets of the widest part of that region, some of them forking near the costa, and a few anastomosing with each other. ♀ very similar, according to Dr. Hagen, with brown eggs. Length of body, ♂ 6–7, ♀ 9; wings, ♂ 8, ♀ 9 millim.

Hab. Corsica (Hagen); Carinthia (Zeller, in M'Lach. Mus.). The above diagnosis is founded upon Carinthian specimens, captured in June.

HABROPHLEBIA UMBRATILIS, sp. nov.

Subimago (dried).—Wings light blackish grey, with opaque neuration.

Imago, ♂.—Upper portion of oculi reddish during life.—(*Dried.*) Thorax piceous, appearing pitch-brown or pitch-black according to the direction and the amount of light in which it is viewed. Abdomen above pitch-brown, with segments 2–7 to a slight extent translucent towards their bases, the pleural margins sometimes remaining dark throughout; the same segments beneath are more extensively translucent, with their joinings pitch-brown and their ganglionic cord subtestaceous, their general colour during life being probably greyer than that of the dorsum. Setæ greyish white or warm sepia-grey, with their alternate joinings warm sepia-brown. Basis and proximal joints of the forceps concolorous with the venter; the remaining joints greyish white. Penis translucent yellowish white, with well-developed reclinate slender spurs beneath. Fore femur and tibia in opaque view pitch-black, the latter darker at the tip, the tarsus testaceous; the femur reflects pitch-brown, the tibia a browner tint than the very light testaceous tarsus; in transmitted light the femur becomes warm translucent pitch-brown, the tibia light brown-ochreous amber, with its extremity somewhat opaque, the tarsus whitish yellow-amber. Hinder legs of lighter colour; the trochanter yellowish white; in opaque view the femora appear bistre-brown or piceous-grey, more opaque towards their distal extremities than elsewhere, and the remainder of the legs dull light brownish testaceous; the femora reflect a translucent light piceous-grey, darker distally, and the remainder of the legs a uniform dull brownish white, of nearly equal depth with the colour of the femora; in transmitted light the whole of the leg is translucent whitish brown amber. Wings vitreous; in the fore wing the longitudinal neuration, the cross veinlets of the pterostigmatic region of the marginal area, and the adjoining cross veinlets of the adjacent area, viewed against an opaque background, appear either bistre-brown or whitish, according to the direction in which the light falls upon them, the former colour persisting longest (during the change of posture) in the cross veinlets specified, the radius, subcosta, and in the distal half of the costa, whilst the remaining cross veinlets are transparent; in transmitted light, a slight yellowish-amber tint is perceptible in the radius, subcosta, and the great cross vein; the marginal area contains about 3 almost

imperceptible traces of cross veinlets before the bulla, and beyond that 6–7 well-defined, simple, nearly straight cross veinlets.

♀ differs from ♂ in the usual manner. Fore leg piceous, the tarsus whitish, with the apical edges of the intermediate joints narrowly darkened; in some lights the tibia as well as the tarsus appears brownish white. Wings tinted almost imperceptibly with greyish; their neuration more distinctly bistre-brown than in the ♂; in the disk of the fore wing, between the costa and the upper branch of the præbrachial (6) nervures, the cross veinlets are well defined; the marginal area contains about 3 almost effaced cross veinlets before the bulla, and beyond that 9, usually all simple and slightly curved. Length of body 5–5·5; wing, ♂ 5, ♀ 6–7; setæ, ♂ im. 8 millim.

Hab. Common at the end of July and beginning of August in the Appennino Pistojese, near San Marcello, at altitudes of 2100–2700 ft. During the afternoon, the flies throng together along the borders of streams in the shade of alders (*Alnus*): hence the name. They are obtainable at other times by beating. The nymphs abounded under suitable stones in the grounds of the Villa Margherita. A ♂ im., captured at an altitude of 4400 ft., near Abetone, has the brownish colour of the hinder legs well marked.

Habrophlebia mesoleuca, Brauer.

Potamanthus mesoleucus, ! Brauer, Neuropt. Austr. 74 bis (1857).

Leptophlebia mesoleuca, ! Etn., Trans. Ent. Soc. London (1873), 397; Rostock, Jahresb. d. Ver. f. Naturk. Zwickau, 1877, p. 84 (1878).

Imago (*dried*), ♂.—Thorax jet-black above. Abdomen in segments 2–7 pellucid white, the remainder reddish brown above. Setæ white [with darker joinings]; forceps white; penis spurred beneath, the spurs rather longer than the lobes, reclinate and slender. Fore legs greyish white; hinder legs white, pellucid [their femora tinged with fuscous]. Wings vitreous; subcosta and radius of the fore wing subpiceous; cross veinlets of the pterostigmatic region curved and mostly simple. Length of body 5, wing 6; setæ, ♂ im. 7 millim.

Hab. Austria, marshy places in the Prater, near Vienna, in June, and in Styria (Brauer); Saxony, very common near Dretschen (Rostock). The foregoing is based upon Dr. Brauer's description, supplemented by original notes made in 1873 of a specimen named by Rostock, and forwarded for inspection by Mr. Albarda. The darker fore femora of *H. lauta* enable it to be separated at a glance from the present species.

Habrophlebia lauta (renamed).

Potamanthus ‡ *cinctus*, Pict., Hist. Nat. Névropt. ii. Ephém. 219, pl. xxviii. 1–6 (1843–5); Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 543 (1853).

Habrophlebia lauta, ! McLach., Rev. d'Ent. iii. 19 (1884) [undescribed].

Subimago (*dried*).—Wings whitish sepia-grey, with concolorous neuration.

Imago (*living*), ♂.—Upper eyes flesh-red [this colour modified in some examples with testaceous], lower eyes black. Thorax jet-black above, varied with a lighter colour at the sides. Abdomen, from segment 2 to the base of segment 7, pellucid white, with the tips of the segments sometimes tinged very faintly with light reddish; the remaining segments subpiceous above, modified beneath more or less, from segment 8 to the tip,

with rusty yellow or dull orange. Setæ and forceps white; penis pitch-brown, changing to testaceous when dried. Fore leg, with the trochanter, femur, and both extremities of the tibia piceous, and the remainder white; hinder legs white, with the tarsus, the extreme base of the tibia, and the extremity of the femur very light dull amber-colour or greyish. Wings vitreous, with pellucid neuration; marginal area of the fore wing with 4–6 hardly perceptible traces of cross veinlets before the nodus and 3–4 beyond it, followed in the pterostigmatic region by 7–10 that are well defined, simple, and almost straight.

♀ (*living*).—Thorax fusco-piceous above. Dorsum of abdomen picco-fuscous; venter lighter; setæ white. The stronger of the longitudinal nervures of the fore wing are faintly tinged with olive-grey. Length of body 5–6; wing 6·5–7; setæ, im. ♂ 9 & 8–11 & 10, ♀ 6·5–7 millim.

Hab. France, at and near Pau (under 600 ft.), June; common in the Vosges, and at Bouillon, Belgium (M'Lach.), July. Switzerland, Münchenbuchsee, Canton Berne, and the stream at Versoix, near Lake Leman, August; near Troinex under Mt. Salève near Geneva (over 1300 ft.), September. Some remarks concerning this species are given above under *Leptophlebia cincta*.

CALLIARCYS, Etn. 1881.

Illustrations. Adult (details), Pls. XIV. 23 (typical). [*N.B.* Pl. XIII. 23*, 2, 3 (provisional), are referred to *Thraulus*.]

Adult.—Hind wing very similar to that of species of *Habrophlebia*, with plenty of cross veinlets and a comparatively narrow form. Cross veinlets numerous in the fore wing, excepting near the inner margin; those in the marginal area before the bulla distinct; some at the terminal margin (which has no isolated veinlets) occasionally constitute here and there simple curved branchlets to longitudinal nervures in individual wings. In the typical specimens, the intercalary nervures of the anal-axillar interspace of the fore wing establish communication with the anal (8) nervure; they are four in number (not counting as one an occasional simple branchlet of the anal nervure), and 3 and 4 are long, 1 and 2 short; intercalars 1, 2, or 3 may terminate abruptly; 1 may be shorter than 2, may curve towards 2 instead of towards the anal, and may be linked by a series of cross veinlets to 3, 2, and the anal; when 3 is abrupt, it is similarly linked to the anal. Aperture of the mesothoracic spiracle without a guard. Forceps-limbs of ♂ 3-jointed; the proximal joint much longer than the remainder, and gradually dilated towards the base. Forceps-basis excised in the middle; the homologous ventral lobe of ♀ bifid and acutely excised. Median caudal seta subequal to the others; those of ♂ nearly $1\frac{1}{2}$ as long as the body. Ungues in every tarsus each unlike the other; fore tarsus of ♂ about $1\frac{1}{4}$ as long as the tibia, which is about $1\frac{1}{5}$ as long as the femur; its joints, in diminishing sequence, rank 2 and 3 subequal, 4, 5, 1; hind tarsus little more than $\frac{1}{3}$ as long as the tibia combined with joint 1, which is ill defined; its joints rank 5, 2, 3, 4. Fore tarsus of ♀ little more than $\frac{1}{2}$ as long as the tibia, which is little longer than the femur; its joints rank 2, 5, 3 subequal to 4, and 1 fairly defined [the proximal joining is too strongly defined in the whole-figure of this leg]. *Nymph* unknown.

Type. C. humilis, Etn.

Distribution. Algarve and Portugal.

Etymology. καλός and ἄρκυς, from the completeness of the reticulation of the wings.

Upon reconsideration, I am disposed to transfer to *Thraulus*, provisionally, the species referred provisionally to the present genus in the writing of Pl. XIII., because the relative lengths of the intercalary nervures of the axilar-anal interspace of their fore wings correspond more nearly with those of the typical *Thraulus* than with those of the typical *Calliarcys*, and also because their ♂ forceps-bases are entire. The oblique acuminate prolongation of the marginal areas of the hind wings of these species led, doubtless, to their being classed otherwise in the first instance. It is extremely probable that they constitute a genus of their own; but the materials at hand do not suffice for its definition.

Calliarcys humilis, Etn. Plate XIV. 23 (wings, legs, and genitalia).

Calliarcys humilis, ! Etn., Ent. Mo. Mag. xviii. 21 (June 1881).

Subimago (*dried*).—Wings ivory-black grey.

Imago (*dried*), ♂.—Thorax jet-black above. Abdomen pitch-brown, with joinings 2–6 narrowly pale. Setæ light warm sepia, with piceous or reddish joinings. Forceps in opaque view light pitch-brown, changing in transmitted light to translucent bistre-brown; the divisions of the forceps-basis singularly prolonged at the points. Fore legs in opaque view piceous, in oblique view reflecting rufo-piceous, and in transmitted light translucent golden-brown amber (like resin or treacle); hinder legs somewhat lighter. Wings transparent, with light pitch-brown neuration, changing to brownish amber in transmitted light; the membrane is tinted perceptibly with a similar but faint light-brownish grey: in the marginal area of the fore wing are 6–7 cross veinlets before the bulla, and 13–18 almost always simple and slightly curved beyond it, all well defined. Length of body, ♂ ♀ 7–9; wing, ♂ 7–8·5, ♀ 9; setæ, ♂ im. 10–11·5 millim.

Hab. Algarve, on the northern slopes of Foia near Monchique, at altitudes of little over 2000 ft. (*e. g.* common near the waterfall at the foot of the final slope, at about 2150 ft.), at the end of May; also in Portugal, in the Estrella, on a hill south of Sabugueiro, at an altitude of about 4100 ft., early in June; in streams having a temperature at that season of 56° Fahrenheit.

Section 6 *of the Genera*.—Type of *Ephemerella*. *Adult*.—Pronotum of ♀ traversed lengthwise by a raised median line or ridge; its posterior border arched, and either truncate or slightly depressed in the middle. Hind tibia rather shorter than the femur; the tarsus about $\frac{2}{3}$ as long as the tibia. In the fore wing the anal (8) and first axillar (9^1) nervures are connivent and mutually contiguous at the wing-roots, apart from the second axillar (9^2) and pobrachial (7) nervures. Penis-lobes distinct; orifices of the seminal ducts terminal; no stimuli apparent. *Nymph* [*Teloganodes* unknown]. Terminal margins of the fore wings connected with the peak of the mesonotum, each by a distinct triangular membrane. Palpus of the 1st maxilla (when present) shorter than the lacinia, which is crowned with a sparse tuft of hair and armed with spinules along its inner edge. Lobes of the labium small, rounded, and subequal to the laciniæ of the 2nd maxillæ. Abdominal tracheal branchiæ fewer than the maximum number in the Family, being absent from the

2nd segment and usually from the first as well; when they exist on segment 1 they are minute, erect, hirsute, and filiform, unlike the others; these, issuing from the posterior margins of the segments at the bases of the pleuræ, are recumbent upon the sides of the dorsum and either imbricated or stratified, and are formed each of a broad pergamentose lamina (or a membranous lamina, if the branchia be wholly obtected), concave on the underside, covering and in some extent coherent with a forked appendage, the support of membranous lamellæ, which are numerous and closely imbricated in the large branchiæ, but very scanty in the small. Many of the pleuræ are dilated so as to form acute serratures at the sides of the abdomen, and their edges, like some other parts of the body (*e. g.* the femora or setæ), are beset with remarkable hairs, which commonly resemble in their structure the peculiar hairs of certain Trombidiid *Acarina* in being filiform or clavate, and in many instances microscopically velutinous or otherwise roughened. Natation laboured, aided by movements of the legs.

The genera of this section display affinity with the type of *Cænis* in the particulars detailed in the last sentence but one of the foregoing paragraph.

North America has yielded several nameless nymphs referable to this section, whose ultimate development needs investigation. Their characteristic differences chiefly reside in the arrangement and form of the tracheal branchiæ, the length of the palpus of the 1st maxilla (when present) and the proportions of its component joints, and in the form of the body—tabulated hereunder. The indications of wing-neuration delineated in their figures are largely conventional. Being for the most part very nearly akin to *Ephemerella*, their detailed descriptions are inserted immediately after the descriptive letterpress of the species of this genus, preceding the description of the Cingalese genus *Teloganodes*, whose nymph is unknown. Those are the only two genera in the section that are named.

Tabulation of Nymphs ranked in Section 6 of the Genera.

Nos. 3–7 of the abdominal segments bear tracheal branchiæ; of these, the first four on each side of the dorsum are loosely imbricate. Antennæ inserted

upon the disk of the frons. Terminal joint of the palpus of maxilla 1. subequal to the remainder; joint 2 longer than joint 1. Caudal setæ narrowly plumose. Branchial laminæ oblique, oblong or ovate oblong ..... Pl. XXXVII. *Ephemerella.*

scarcely $\frac{1}{2}$ as long as the remainder; joint 2 subequal to joint 1. Branchial laminæ somewhat obovate..... Pl. XXXVIII. 1–10.

scarcely $\frac{1}{3}$ as long as the remainder; joint 2 about $\frac{1}{4}$ as long as joint 1. Branchial laminæ subrotund..... Pl. XXXVIII. 11–15.

in re-entering angles at the front lateral margins of the frons. Terminal joint of the palpus of maxilla 1. about $\frac{1}{5}$ as long as the remainder; joint 2 about $\frac{2}{3}$ as long as joint 1. Branchial laminæ somewhat oblong and slightly oblique. Ventral surface of the body singularly adapted for adhesion to smooth surfaces..... Pl. XXXIX.

Nos. 4–7 of the abdominal segments bear tracheal branchiæ; the laminæ, irregularly subovate, are compactly imbricate. Caudal setæ plumose.

Antennæ inserted upon the disk of the frons. Terminal joint of the palpus of maxilla 1. about $\frac{2}{3}$ as long as the remainder; joint 2 less than $\frac{1}{2}$ as long as joint 1 ..... Pl. XL. 1–17.

Nos. 1 and 4–7 of the abdominal segments bear tracheal branchiæ; the first is subulate and erect; the others are of normal structure, their laminæ ovate-oblong and compactly stratified; the laminæ of those of segment 4 are each traversed by a slight furrow from side to side beyond their middle, serving as a hinge. Caudal setæ plumose. Antennæ inserted upon the disk of the frons. Palpus of maxilla 1. lost [or aborted ?] Pls. XL. 18–20 & LXIV. 3–8.

EPHEMERELLA, Walsh, 1862.

Illustrations. *Adult* (details), Pl. XIV. 24 *a–c* [wings, legs, ♂ head and genitalia]; Etn., Trans. Ent. Soc. London (1871), pl. ii. 5 [part of fore wing]:—(whole figures) see under *E. ignita*, synonyms *Potamanthus*, Pictet, *op. cit.* pls. 30, 31, & 33. *Nymph*, Pl. XXXVII.; also Pictet, *op. cit.* pls. 29 & 33, and Vayssière, Ann. des Sc. Nat. (6) xiii. pl. viii. 74 &c. (1882).

Adult.—Hind wing of moderate size, unevenly arcuate in front, with a very shallow marginal depression just beyond the most salient portion of the costa; the subcosta (2) advancing from the wing-roots in a bold curve towards that prominence, proceeds, in proximity to the costa from thereabouts, almost in a direct course towards the obtuse extremity of the wing, and meets the margin obliquely rather near the termination of the radius (3); this last nervure, more gently curved, approaches the subcosta gradually, and attains the tip of the wing: the intercalar neuration is well developed, and cross veinlets are numerous. In both wings most of the intercalary veinlets remain isolated and rudimental, comparatively few of them obtaining connection with longitudinal nervures. Cross veinlets plentiful in the larger portion of the fore wing, but scarce or absent in the immediate vicinage of the terminal margin and within the area bounded anteriorly by the anal (8) nervure, and absent from the marginal area before the bulla; those of the pterostigmatic space, in all the described species, are for the most part divided near the costa, and their branchlets intercommunicate so as to enclose a series of small irregular cellules upon the costa. In the anal-axillar interspace of the same wing are 3 long intercalar nervures, and as few or fewer short isolated rudiments of others, one of the latter usually standing in the interval between the first and the second of the former. Of the three longer intercalars quoted, the intermediate is the longest; and this is connected with the anal nervure either directly (turning aside a little, anteriorly, to unite with it as a branch) or indirectly (by blending with a cross veinlet), and sometimes, in addition to that terminal connection, a cross veinlet establishes further communication between them. In like manner the first of the three may be connected directly or indirectly with the anal nervure, and the third with the second intercalar; otherwise the first remains isolated, and the third is simultaneously in communication both with the first axillar (9^1) and with the intermediate intercalar nervures by uniting at its inward extremity with cross veinlets [compare Etn., *op. supra cit.* pl. ii. 5. Pictet's figure, Pict. *op. ibidem cit.* pl. xxxii. 1, is untrustworthy in detail]. Guard at the aperture of the mesothoracic spiracle small and triangular. Forceps-limbs of ♂ 3-jointed, stout, the intermediate joint long, the others very short.

Abdomen of ordinary proportions; segments 2–7 of nearly uniform length, shorter than segment 8 (which is the longest) or 9; segment 10 short; the postero-lateral angles of the dorsum in segments 8 and 9 are acute and slightly prolonged; forceps-basis entire, the homologous lamina of the ♀ obtuse. Lobes of the penis without apparent stimuli. Median caudal seta subequal to the others, which in both sexes are about as long as the body. Ungues in every tarsus dissimilar each to the other. Fore tarsus of ♂ about $1\frac{1}{5}$ as long as the tibia, which is nearly twice as long as the femur; its joints, in diminishing order, rank 2 & 3 subequal, 4, 5, and 1. Fore tarsus of ♀ (excluding joint 1) about $\frac{3}{4}$ as long as the tibia and joint 1 combined; the femur about as long as the tarsus, whose joints rank 2, 3, 5, 4. Hind tarsus (excluding joint 1) about $\frac{5}{7}$ as long as the tibia and joint 1 combined; its joints rank 5, 2, 3 subequal to 4. The first joint in these tarsi is obsolescent. *Nymph* latent under stones or at the roots of water-weeds, in streams and rivers. Body broadest at the mesothorax; head slightly narrower than the pronotum, and in anterior view trilateral, with the vertex arched and the oral region truncate; antennæ inserted about midway between the anterior ocellus and the sides of the face; that ocellus is smaller than the others; oculi moderately distant from each other in ♂. Pronotum transversely quadrangular, arched above, nearly straight at the sides, and obtuse at the anterior lateral angles. Abdomen plump, slightly convex beneath, and somewhat quadrangularly arched above in segments 2–9; pleuræ dilated considerably in segments 3–8, slightly concave above, fringed with clavate or spathulate hairs, and contributing to form, with the steeply sloping sides of the dorsum, a hollow for the lodgment of the tracheal branchiæ; those of segments 2 and 3 are obliquely truncate at their posterior angles, but the pleuræ of segments 4–7 are there acuminately pointed, and constitute a series of uncinate serratures on each side of the body; the pleuræ of segment 8, less largely developed than their predecessors, are posteriorly more acutely pointed in ♂ than in ♀; those of segment 9 terminate behind each in a triangular point, which is perpetuated in the imago. The angularity of the dorsal arch, above referred to, is due to longitudinal series of protuberances, ridges, or tubercles, one on each side of the middle of the back, extending from segments 2–9; in segments 2 and 3 each prominence is surmounted by an acute conical tubercle; in segments 4–7 each ridge terminates behind in an uniform tubercle pointing towards the tails; in segments 8 and 9 the ridges end abruptly. Abdomen broadest in segment 4 or 5, narrower posteriorly than in front; a line drawn touching the outer edges of the pleuræ on each side would describe a curve. Tracheal branchiæ are borne by segments 3–7, and diminish in size successively from the foremost; those of segment 7 are completely obtected by the preceding pair. The foremost laminæ are broad and obliquely quadrilateral, with the corners obtuse or rounded off, and have their greatest extension between the lower anterior and the upper posterior corners; the margin below the latter of these is slightly retuse; the trachea enters the lamina near the former. The hindermost of the tracheal branchiæ have ovate laminæ, auricled obtusely at the base on the lower side. The other branchiæ exhibit gradations of form intermediate between these. Caudal setæ nearly $\frac{3}{4}$ as long as the body; for some distance from the roots only their joinings are setulose and their joints nude; afterwards, until shortly before their extremities, the joinings are beset with

longer and sharper setulæ, mingled with minute spreading hairs, while the joints become narrowly plumose or distichously pubescent; towards their extremities the joints are again nude, and their joinings beset with verticils of very minute hairs. Palpus of maxilla I. about $\frac{3}{4}$ as long as the lacinia; its terminal joint is subequal in length to the remainder, and joint 2 is longer than joint 1. Laciniæ of maxilla II. broader than the lobes of the labium. Hind leg the longest; the tarsus (claw excluded) about $\frac{1}{3}$ as long as the tibia. Fore femur smooth underneath in the typical species; the tarsus nearly $\frac{2}{3}$ as long as the tibia. Antennæ setaceous, of moderate length, with minute verticillate hairs at the joinings.

Synonymy. *Leptophlebia*, Westwood, 1840 (part); *Potamanthus*, Pictet, 1843–5 (part).

Type. *E. excrucians*, Walsh.

Distribution. Northern Temperate Regions.

Etymology. A hybrid combination of a Greek derivative with the Latin diminutive "ella."

Nymphs of the typical form inhabit N. America as well as Europe. *E. ignita* ♂ im., with *L. marginata* ♀ im., were contypical of the unrestricted *Leptophlebia*.

EPHEMERELLA IGNITA, Poda. Plate XIV. *a* (legs, ♂ head and forceps).

Ephemera ignita, Poda, Ins. Mus. Græc. 97 (1761).—*E. erythrophthalma*, Schr., Fn. Boica, ii. pars ii. 197 (1798).—*E.* ‡*fusca*, ! & *diluta*, Steph., Ill. Brit. Ent. vi. 58 (1835).—*E. apicalis*, ! *rufescens*, ! & *rosea*, ! id., *op. cit.* vi. 59 (1835).

‡ *Baetis obscura*, ! id., *op. cit.* vi. 65 (1835); Walk., List of Neurop. Ins. in Brit. Mus. part iii. 558 (1853).

Potamanthus erythrophthalmus, Pict., Hist. Nat. Névropt. ii. Ephém. 222, pls. xxix. [written in error "*erythrocephalus* (larve)"] & xxx. [adult] (1843–5); Walk., List &c. 544 (1853); Hag., Ent. Ann. (1863), 21.—? *P. gibbus*, Pict., Hist. &c. 226, pls. xxxi. & xxxii. [im. & subim.] (1843–5); Walk., List &c. 544 (1853).—? *P. æneus*, Pict., Hist. &c. 229, pl. xxxiii. [egg, nymph, subim., & adult] (1843–5); Walk., List &c. 545 (1853).—*P. apicalis*, Pict., Hist. &c. 236 (1843–5); Walk., List &c. 544 (1853).—*P. dilectus* [for *dilutus*], Pict., Hist. &c. 236 (1843–5).—*P. dilutus*, Walk., List &c. 545 (1853); Hag., Ent. Ann. (1863), 19.—*P. roseus*, Pict., Hist. &c. 236 (1843–5); Walk., List &c. 545 (1853).

Ephemerella ignita, ! Etn., Trans. Ent. Soc. London (1871), 98, pls. ii. 5 [wing] & v. 7–7 *a* [details]; Meyer-Dür, Bull. Soc. Ent. Suisse iv. 316 (1874); Rostock, Jahresb. d. Ver. f. Naturk. Zwickau, 1877, p. 85 (1878).—? *E. gibba*, Etn., Trans. Ent. Soc. London (1871), 99; Meyer-Dür, Bull. Soc. Ent. Suisse, iv. 316 (1874); Rostock, Jahresb. d. Ver. f. Naturk. Zwickau, 1877, p. 85 (1878).—? *E. ænea*, Etn., Trans. Ent. Soc. London (1871), 99; Meyer-Dür, Bull. Soc. Ent. Suisse, iv. 316 (1874).

Subimago (*living*).—Wings black-grey, the wing-roots and sometimes the hind wings greyish white. Femora olive-grey, often with a dark band before their distal extremity; tibiæ grey; tarsi black-grey or grey-black. Setæ brownish grey with red-brown joinings.

Imago, ♂ (*living*).—Upper division of eyes brownish red or burnt sienna; lower division olivaceous, or sometimes rather yellower. Head and prothorax olivaceo-fuscous; meso- and metanotum fuscous or jet-black. Abdomen above dark reddish fuscous, with the opaque tips of the segments sometimes narrowly ochraceous, and often with the sides of the segments tinged with the same colour; the last segment paler, sometimes dull greenish: venter sometimes light- or warm-sepia brown, sometimes fuscous or greenish

fuscous, the segments sometimes each with a pair of short dark divergent lines followed by two dots at the base, the 9th segment often brown-ochreous, with a longitudinal piceous streak along each side. Setæ sepia-grey with darker joinings; forceps testaceous or greenish grey. Legs either almost sulphureous, with the fore tibia lutescent and all the tarsi testaceous; or with the fore femur yellowish- or olivaceous-grey, the hinder femora paler and tinged rather more with yellowish, the fore tibia dark olive-grey, the tarsi and hinder tibiæ grey; a diffused obsolescent or nebulous rubigineous band is sometimes perceptible at the extremity of the femur, and the ungues are often piceous. Wings vitreous, with the stronger nervures and sometimes the bulla almost faintly piceous or amber-colour.

♀ (*living*).—Eyes dark olivaceous; vertex of head marbled with black, pale ochreous or orange, and grey. Pronotum olivaceo-fuscous varied with pitch-brown. Meso- and metanotum pitch-brown. Abdomen more opaque and tinged with dull greenish than in the ♂, but rather similar: the borders of the dorsal vessel dark. Legs olivaceous, the femora with a grey band just before their pale distal extremity, the fore tibia sometimes testaceous, the tarsi greyish. Wings much as in the ♂, but sometimes with the bulla more distinctly coloured. The ventral lobe of the penultimate segment is slightly retuse; and the pleuræ of the 8th segment are posteriorly acute. Eggs green, becoming browner when dried. Length of body, ♂ 6–9, ♀ 6–10; wing, ♂ 7–9, ♀ 7·5–11; setæ, ♀ im. 7 & 8–12 & 11, subim. 8 & 7; setæ, ♀ im. 7 & 8–8 & 9, subim. 7 & 9 millim.

Hab. Europe, from Portugal, near Cintra (300–400 ft. alt.), Madrid, and mid-Italy, near San Marcello, in the Apennino Pistojese (2100–2700 ft. alt.), northwards to Great Britain, and at least to Holland and Germany; but the extent of its continental range farther north and east is not yet ascertained. In England the fly is plentiful from June till September; but it was common at the end of April in Portugal. The nymph varies greatly in colour; the darkest and most strongly marked specimens are prevalent in trout-streams, those of lighter colours in warmer streams and rivers, the variations being largely determined by the nature of the bottom. I believe that Pictet was mistaken in describing as distinct species merely colour-variations of this one; and that some of the differences indicated by him in the adult flies are attributable to the ordinary mutations of colour undergone by them during their advance to full maturity, and during the decline of life. The form of the forceps-basis in my earlier figure (1871) differs from that in Pl. XIV. 24 *a*, in the breadth of the extremity of the median projection; but this is only because the insect was then not adjusted so well for drawing as the more recent subject. The part which is shaded thereabouts in the former figure was hidden when the newer drawing was made, and the acute unshaded portion was brought into full view, by throwing the extremity of the insect further back.

Ephemerella inermis, sp. nov.

Subimago (*dried*).—Fore wings transparent, light brownish grey, with neuration in some lights dull greenish grey, changing in other lights to dull light yellowish, the membrane and opaque longitudinal nervures becoming dirty brownish white near the wing-roots; hind wings rather pale. Setæ dark sepia-grey, with black joinings. Legs

dull light-brownish yellowish, the fore tarsus and distal portion of the tibia, and in the hinder tarsi the ungues, tip of the terminal joint, and distal borders of the other joints brownish, the brown being sometimes modified with reddish.

Imago (*dried*), ♂.—Thorax above polished, and of a rich deep pitch-brown, the anterior half of the mesonotum in one example much lighter in the midst. Abdomen above either pitch-brown, with the last 3 segments rufescent, and the lateral borders of the dorsum light yellowish; or dark rufo-piceous, with the last segment yellowish; the joinings opaque. Venter lighter than the dorsum; genitalia light yellowish. Setæ whitish sepia-grey, with black joinings. Wings vitreous; the neuration in some lights colourless, the longitudinal nervures in other lights becoming faintly tinged with light greenish grey, changing in other positions to very light amber; at the wing-roots of the fore wing is, apparently, a light pitch-brown spot. Fore leg, as an opaque object, dull greenish grey, with the coxa, trochanter, and knee lighter, the tarsus dirty whitish or greyish white, with the joinings and ungues brownish; in transmitted light the femur becomes light yellow-amber. Hinder legs in opaque view, with the femur and base of the tibia, yellowish amber, the distal portion of the tibia, and the tarsus dirty whitish, the latter having the ungues, the end of the terminal joint, and the distal borders of the other joints light reddish-brown.

♀. Thorax above polished brown-ochreous; the pronotum destitute of raised dots. Abdomen discoloured; ventral lobe of the 9th segment broadly rounded and almost entire, the pleural points obtuse. Wings as in ♂, but with the longitudinal nervures rather more definitely coloured. Legs very similar to the hinder legs of the ♂, but in one of the specimens only the ungues and not the joinings of the hinder tarsi are light brownish. Length of body, 5–6; wing, 6–8 millim.

Hab. Colorado, at Denver, Arkansas Cañon, and Colorado Springs (Mus. Comp. Zool. Cambridge, Mass.).

Ephemerella grandis, sp. nov. Plate XIV. 24 *b* (neuration).

Subimago (*dried*).—Wings dark sepia-grey, or sometimes of a slightly blacker grey, with dark neuration, excepting at their extreme base, where both nervures and membrane are more or less of a dull greenish-yellow, varied with brownish. Coxæ, trochanters, hinder tibiæ and tarsi, fore tarsus, and sometimes the fore tibia very pale reddish (burnt-umber) brown: femora pitch-brown. Setæ pitch-black at the base and then sepia-brown.

Imago, ♀ (*dried*).—Thorax bright brown-ochreous. Abdomen shrunken through desiccation, and discoloured; in one example the colours along the middle of the dorsum have considerably changed, but on both sides the segments are narrowly bordered with dull ochraceous along the pleuræ, and a series of large rounded blotches of a dark purplish brown colour [pitch-brown modified with intense burnt-carmine] occupies the immediately adjoining parts of the intermediate segments (perhaps excepting segment 9). Setæ in opaque view pitch-black near the roots and then pitch-brown; in transmitted light the black changes to pitch-brown, and the lighter parts appear whitish warm sepia-grey, with rufescent joinings. Ventral lobe of segment 9 emarginate; the pleural points

short and acute. Wings vitreous, the fore wings tinged slightly with light brownish grey in the pterostigmatic region of the marginal and submarginal areas; neuration piceous, strongly defined (excepting the cross veinlets in a large extent of the marginal and submarginal areas, and those in a small portion of the next area of the fore wing), the longitudinal nervures becoming lighter at the wing-roots. Fore legs in opaque view pitch-brown, lighter or more nearly raw-umber brown from the coxa to the base of the femur; in transmitted light the tibia and tarsus are less opaque than the femur, the dark parts become rufo-piceous, and the lighter parts somewhat of an amber-colour. Hinder femora similar in colour to the fore femur; but the tibiæ and tarsi are uniformly whitish yellow-ochre, with the ultimate joints and ungues, or in some lights the whole of the tarsus, clove-brown. Length of wing, ♀ 15–18; setæ, ♀ im. 16–17, subim. 15 millim.

Hab. Colorado (M'Lach. Mus.); The Geysers, Yellowstone, 4th of May (Mus. Comp. Zool. Cambridge, Mass.). The arrangement of the colouring matter of the abdomen in the specimen described above is not to be implicitly trusted.

Ephemerella Walkeri (renamed).

‡ *Baëtis* ‖ *fuscata*, ! Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 570 (1853) [part]: Hag., Smithson. Miscell. Coll. (1861), Synop. Neuropt. N. Am. 47.

Imago, ♂ (*dried*).—Thorax above dark pitch-brown, varied on the pleuræ and sternum with light burnt-umber brown. Abdomen discoloured, dark pitch-brown. "Fore legs piceous" (*teste* Walk.); hinder femora dark rufo-piceous, the tibiæ and tarsi dull pale subtestaceous. Wings transparent, their longitudinal neuration in some lights pale fuscescent. Length of wing 8 millim.

Hab. St. Martin's Falls, Albany River, Hudson's Bay (Dr. Barnston); one example in Brit. Mus. The ♂ subimago doubtfully referred to this species by Mr. F. Walker is still in the collection, and is most probably a *Rhithrogena*. The name given by Walker to this species, having been preoccupied in *Baëtis*, is superseded: had he not published a description of the type-specimen, it might well have remained nameless and undescribed.

Ephemerella invaria, Walker. Plate XIV. 24 *c* (penis).

‡ *Baëtis invaria*, ! Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 568 (1853); Hag., Smithson. Miscell. Coll. (1861), Synop. Neuropt. N. Am. 48.

Ephemerella invaria, ! Etn., Ent. Mo. Mag. v. 87 (1868); ! id., Trans. Ent. Soc. London (1871), 100, pl. v. 8, 8 *a* [details].

Imago, ♂ (*dried*).—Thorax above light rufo-piceous; abdomen discoloured,—dorsum fuscescent, the joinings opaque, the last two segments modified with light dull reddish orange,—venter greyish, the base of the forceps, and the two or three segments immediately preceding it, light brown ochre. Fore femur and tibia reddish golden brown, the latter with a dull light reddish spot near its distal extremity, the tarsus yellowish white; hinder femora translucent, very light straw-colour or pale yellowish-fuscescent, the tibiæ and tarsi dull whitish, with the apical edges of the joints and the ungues fuscescent. Wings transparent, their neuration usually colourless, but in one instance distinctly pale fuscescent. Length of wing 8–10 millim.

Hab. St. Martin's Falls, Albany River, Hudson's Bay (Dr. Barnston); 3 examples in Brit. Mus.

EPHEMERELLA EXCRUCIANS, Walsh.

Ephemerella [type] *excrucians*, ! Walsh, Proc. Acad. Nat. Sc. Philad. (1862), 377; Hag., Proc. Ent. Soc. Philad. ii. 178 (1863).—*E.* ‡ *invaria* (part), ! Etn., Trans. Ent. Soc. London (1871), 100.

Subimago (*dried*).—Wings very light ochraceous grey, changing in some postures to whitish grey, with subopaque neuration of a similar whitish- or faintly whitish yellow-amber tint. ♂ femora in opaque view light yellow-ochre, changing to light yellow-amber in transmitted light; tibiæ and tarsi dull whitish, the ungues and ends of the terminal joints of the hinder tarsi brownish, the fore tibia and tarsus in opaque view dull brownish, but in some lights dull yellowish; legs of ♀ lighter, with pale brownish ungues. Setæ light sepia-grey, their joinings at most opaque.

Imago, ♂. [Oculi in life (*fide* Walsh) egg-yellow above, pale fuscous below.]—(*Dried*):—Thorax above piceous or light rufo-piceous: abdomen rufo- or fusco-piceous above, with opaque joinings, the last two segments tinged with dull light reddish orange; venter greyish or yellowish, the last two or three segments and the bases of the forceps light brown ochreous. Setæ whitish, with fuscous joinings. Wings vitreous, with colourless neuration. Hinder femora very light yellow-amber; fore femora darker, and of a browner yellow-amber in opaque view; hinder tibiæ and tarsi dull yellowish or brownish white, the tips of the tarsi and the ungues light brownish; fore tibia in opaque view dull yellowish brown, with a light brownish spot at the tip, the tarsus rather lighter, with brown ungues, but in transmitted light they are both brown-ochreous white, the tibia becoming light yellowish amber towards its base, but marked at the tip, as before, with the opaque brown spot.

♀ (*dried*).—Body yellow-ochreous, the head, pronotum, and abdomen sometimes reddened, the abdominal joinings subopaque or darker than the rest of the segments: on each side of the pronotum, close to the hinder border, directly in front of the sutural furrow in advance of the wing-roots, is a raised reddish-brown dot. Legs similar to the hinder legs of the ♂. Wings vitreous, with colourless or whitish neuration, the fore wings with 9–11 cross veinlets in the marginal area beyond the bulla (counting them along the subcosta). Setæ white, sometimes with the first 2 or 3 joinings reddish. Venter nearly of the same colour as the femora in segs. 1–7, and then darker; the lobe of the 9th segment broadly rounded off and almost entire. Length of body (after Walsh), 5·5–7·5; wing, 6–8; setæ, ♂ im. 11–13, ♀ 9–12·5 millim.

Hab. Rock Island, Ill. (Walsh); Detroit, Mich. (Mus. Comp. Zool. Cambridge, Mass.). Two ♂ im. in the Brit. Mus. were named by Mr. Walsh.

EPHEMERELLA CONSIMILIS, Walsh.

Ephemerella consimilis, Walsh, Proc. Acad. Nat. Sc. Philad. (1862), 378; Etn., Trans. Ent. Soc. London (1871), 100.

According to Mr. Walsh, this insect differs from *E. excrucians* in the form of the mesothorax, which in *E. consimilis* is 4–5 times as long as wide instead of less than thrice

as long as wide, and has the præscutum half as long again as wide instead of scarcely longer than wide. Sternum ferruginous, legs immaculate, but the tip of the fore tibia and the adjacent joint of the tarsus in the ♂ fuscous. Length of body, ♂ 5, setæ about 5; expanse of wings 14 millim.

Hab. Rock Island, Ill. Described from a single defective specimen.

Several undescribed North-American species of *Ephemerella* are scantily represented in the collections referred to, which it seems undesirable to characterize.

Ephemerella elongatula, M'Lachlan.

Leptophlebia elongatula, ! M'Lach., Trans. Ent. Soc. London (1875), 169 (part).

Imago (*dried*), ♀.—Body intense jecinoreus. Setæ blackish fuscous. Wings vitreous, with the costal margins of the fore wings narrowly brownish yellow; neuration fuscescent, the longitudinal nervures towards the wing-roots, and the proximal halves of the subcosta and radius of the fore wing, yellowish. Length of wing 14 millim. [Abstracted from M'Lachlan's description.]

Hab. Yokohama (Pryer, in Wormald's Mus.). The ♀ subimago attributed to this species in 1875, probably through an error on my part, is apparently a *Heptagenia*.

Five Nymphs allied to *Ephemerella*, *sedis incertæ*.

Nymph No. I.—Pl. XXXVIII. 1–10 (whole figure & details).

Perhaps an *Ephemerella*, but differing from the nymph of the typical form in the following particulars. Abdomen broadest in front, tapering gradually to the end of the 9th segment; the pleuræ nearly straight along their outer sides, their hinder corners in segments 4–7 nearly right-angled, those in segments 8 and 9 shortly prolonged into acute triangular points; a line drawn touching the outer edges of the pleuræ on each side would be curved only in a very slight degree. Tracheal branchiæ obtusely rounded off distally. Anterior, or inferior, edge of the fore femur minutely denticulated. Joints 1 and 2 of the palpus of maxilla 1. subequal to each other; joint 3 rather shorter. Length of body 8·5, setæ 6 millim.

Hab. Washington Territory; Wenass V., W. T., Taylor's, 6th July; Klikitat V., W. T., Thorpe's, 10th July, S. Henshaw (Mus. Comp. Zool. Cambridge, Mass.).

Nymph No. II.—Pl. XXXVIII. 11–15 (whole figure & details).

Perhaps an *Ephemerella*, tuberculate on the vertex of the head and the notum, and with rows of spines instead of tubercles on the dorsum; also with the abdominal pleuræ wider than in the typical species, and the proximal joint of the palpus of maxilla 1. relatively longer.—Head vertical, with an erect elevated and acute triquetrous tubercle on each side of the crown above the inner orbit of the oculus, terminating a low blunt ridge ascending in a curve from near the posterior ocellus, and with a small rounded wart-like protuberance on the vertex, intermediate between that and the median longitudinal ridge; occipital border slightly prominent. Pronotum narrower in front than behind,

sparingly tuberculated at the sides, and posteriorly near the middle. Mesonotum with a pair of small tubercles on the præscutum, another tubercle at each of the lateral angles of the scutum, and a single tubercle on the scutellum. The dorsal spines on segments 3–9 are slender and somewhat uniform, with their points directed posteriorly. Length of body 14; outer setæ about 9 millim.

Hab. Klikitat V., W. T., Thorpe's (10. vii.; S. Henshaw, in Mus. Comp. Zool. Cambridge, Mass.).

Nymph No. III.—Pl. XXXIX. (whole figure & details).

Body stouter than in the typical *Ephemerella*, and with neither tubercles nor spines upon the dorsum; sternum and venter apparently adapted for adhesion to smooth surfaces; antennæ remote from the ocelli, and inserted in the angles of right-angled excisions at the sides of the prominent front border of the frons; first joint of the palpus of maxilla 1. about $1\frac{1}{3}$ as long as the second, the terminal joint about $\frac{1}{5}$ as long as these combined.—Body broadest at the mesothorax, narrowed in front; abdomen somewhat oniscoidal, broadest at the third and fourth segments; the pleuræ in segments 2–8 broad and relatively short, concave above, strongly rounded off in front, their outer margins less curved and meeting their oblique posterior margins at an acute angle; the pleuræ of segment 9 narrower and posteriorly more acute, the segment in dorsal view resembling somewhat a mitre with the cleft choked seen sideways; dorsum strongly arched, furrowed obliquely at the sides in segments 2–7 by grooves which ascend singly from their front margins at the bases of the pleuræ. These grooves are displayed in fig. 2. Venter densely velutinous, and (exclusive of the pleuræ) elongate-ovate, almost plane behind (the pleuræ being only very slightly prominent), but with a deep arched depression in front of the third segment, wherein is situated a smooth nude curved transverse furrow immediately adjacent to the anterior velvety boundary of the adhesive surface. This furrow is probably the channel for the readmission of water into the enclosure when the insect desires to be free after adhesion has been established. Beneath the thorax are two large and deep nude concavities, bounded by prominent sharply defined even margins, and divided from one another in front of the mesosternum; the anterior is widened angularly close behind the fore coxæ; the posterior resembles the impressure of an axe-head laid flat, edge towards the tail. Pronotum transverse, widest behind; its posterior lateral angles acute. Head vertical, transverse; in front view quadrilateral, slightly oblong and flattened; frons prominent and truncate in front (where it projects in advance of the mouth-parts), angularly excised at its anterior angles, and with nearly parallel sides; antennæ short; mouth-parts similar in type of construction to those of *Ephemerella*. Legs moderately long; femora flattened behind, spinulose or denticulated along their edges; hind tarsus about $\frac{3}{5}$ as long as the tibia. Tracheal branchiæ arranged as in *Ephemerella*, but their laminæ more obtuse. Length of body, ♀, 11, setæ 4 millim.

Hab. Colorado, in a brook at Idaho, adhering to the underside of a board, 5th July; Roaring Water Fork, Col., 2nd August, Lt. Wheeler (Mus. Comp. Zool. Cambridge, Mass.).

Nymph No. IV.—Pl. XL. 1–17 (whole figure & details).

Synonymy. ? *Heptagenia* ‡ *pudica* (nympha-skin), ! Hâg. Ann. Rep. U. S. Geol. & Geograph. Survey of the Terr. 1873, part iii. Zool. 582 (1875) [not *subimago*, p. 581].

Nymph-slough.—Mouth-organs and tracheal branchiæ of a type similar to those of *Ephemerella*; body stouter, the abdomen in its broadest part wider than the thorax, the dorsum unarmed, the venter convex; antennæ inserted about midway between the anterior ocellus and the sides of the face; first joint of the palpus of maxilla I. upwards of twice as long as the second, the terminal joint about $\frac{2}{5}$ as long as these combined; tracheal branchiæ borne by segments 4–7 of the abdomen, but probably absent from segment 1.—Body broadest at about the fifth abdominal segment, narrowed thence in both directions, but nearly as broad in the mesothorax; abdomen broadly oniscoidal, the pleuræ strongly developed in segments 2–9, and produced into slender acuminate recurved teeth, which are pilose where the tracheal branchiæ do not overlap them; the penultimate segment the longest, in dorsal view somewhat similar to a mitre with the cleft partly choked seen sideways. Caudal setæ of ♀ mutually subequal in length, and very nearly $\frac{1}{2}$ as long as the body; median seta plumose; outer setæ ciliated on the inner side near the roots, and plumose distally. Pronotum transverse, quadrangular, rather broader behind than in front, gently arched, slightly compressed on each side, and armed with a short conical tubercle on each side in the middle near the border. Legs pilose, very similar in their proportions to those of *Ephemerella*; femora prolonged at the knee each into a short acute spine; intermediate coxæ each armed above with a short conical tubercle. Head small, transverse, narrower than the pronotum, wider in front than behind, slightly constricted at the junction of the frons and vertex; integument minutely spinulose on the frons, pilose at the sides and in front; vertex transverse, oculi contiguous in ♂; frons prominent at the base in the vicinage of the ocelli and antennæ, and then broadly flattened out so as to form a transverse and projecting ledge or guard over and in advance of the mouth-parts, which ledge is truncate in front, rounded off at the fore corners (where it is broadest), straight-sided, narrowed posteriorly, and much wider than long. Length of body 15, setæ 7 millim.

Hab. Colorado, mountains and plains (Lieut. W. L. Carpenter; Mus. Comp. Zool. Cambridge, Mass.). The laminæ of the tracheal branchiæ of segments 4 & 5 are emarginate below the tip on one side; those of the other segments are entire. The palpi of maxillæ II., formerly described as 2-jointed, have 3 joints; but the small terminal joint is difficult to trace in the cast slough. The sloughs of the hind wings are separate from those of the fore wings, and are attached in the usual manner to only the hind border of the metanotum; their tips attain the base of the second abdominal segment. They were formerly described as being incorporated into the notal hood, in a manner similar to the hind wings of *Bætisca*.

Nymph No. V.—Pl. XL. 18–20, & LXIV. 3–7 (whole figure & tracheal branchiæ).

Body moderately stout; mouth-organs and hinder pairs of tracheal branchiæ similar in type of construction to those of *Ephemerella*; abdomen in its broadest part wider

than the thorax, the dorsum tuberculated as in *Ephemerella*, the venter convex; insertion of antennæ intermediate between the anterior ocellus and the sides of the face; palpus of maxilla 1. lost (or aborted?) in the specimen examined; tracheal branchiæ borne by segments 1 & 4–7 arranged as in *Cænis*.—Body broadest at about the fifth abdominal segment, narrowed thence towards the thorax and tails; abdomen oniscoidal, the segments very similar in form to those of Nymph No. IV, having the intermediate pleuræ produced in like manner into curved acuminate retrorse serratures (which are spinulose along their front edges and beset with long, fine scattered hairs), but having a series of uncinate tubercles on each side of the median line of the dorsum, extending from the first to the sixth segment, the tubercles standing singly at the hinder edges of the segments pointing backwards, and represented in the following three segments by small marginal teeth. Caudal setæ acutely and narrowly plumose, about $\frac{3}{4}$ as long as the body. Pronotum transverse, quadrangular with almost straight sides, about as broad as the head in front, and very little broader behind. Legs very like those of *Ephemerella*. Tracheal branchiæ of segment 1 minute, erect, 2-jointed, with the first joint short and the second joint more slender, filiform, and distally pilose or pubescent, arising from the dorso-pleural region rather behind the middle of the segment and near the lateral borders; those of segments 4–7 inserted in sinuses at the hinder bases of the pleuræ, and composed, like those of *Ephemerella*, each of a lamina sheltering lamellæ, but differing from their homologues in that genus in being compactly stratified rather than imbricated, those of segment 4 elytroidally shielding the others. Moreover, the branchial laminæ of at least segments 4–6 are each traversed by a crease from side to side, situated at about $\frac{3}{5}$ of the distance from the roots to the tip; and while the foremost is pergamentose in texture, all the other laminæ are papyraceous or membranous; whereas in the genus quoted the laminæ are not creased, and only the hindermost in each series is papyraceous. The laminæ diminish successively, chiefly in length; their form in segment 4 is narrowly suboval, somewhat abrupt at the base; in segment 5 each is broadly oval, truncate at the base; in segment 6 the laminæ are rotundate-subquadrate; the hindermost are almost semi-rotund. Length of body, ♂ 12, setæ 5 millim.

Hab. Detroit, Mich. (Mus. Comp. Zool. Cambridge, Mas.); M'Collam's Lake, M'Henry, Ill. (May; Foster in Mus. State Lab. Nat. Hist., Ill.). The eyes of the adult must be ascalaphoid; but the hind wings of the nymph differ from those of described genera of this section.

TELOGANODES, Etn. 1882.

Illustrations. Adult (wings), Pl. XV. 24 *bis*.

Adult.—Hind wing minute, obovate-oblong, angular in front nearly in the middle, with the apex of the angle inverted, and with the margin beyond the angle slightly concave; neuration very simple, consisting of the subcosta (2), radius (3), cubitus (5), and præbrachial (6), with or without a sector, and with scarcely a cross veinlet; subcosta nearly straight, terminating abruptly near the salient angle without meeting the costa; the common stem of the radius and cubitus makes an acute angle with the subcosta, and is met by the cubitus at a distance of about $\frac{1}{3}$ of the wing's length from the wing-roots;

the irregularly sublinear marginal area is broadest in proximity to the great cross vein; the submarginal area, widest at the anterior angle of the wing, and subtriangular in form, with its outer side slightly concave, contains a few traces of obsolescent cross veinlets, of which another is sometimes distinguishable in the next area subjacent. In the fore wing, most of the intercalary nervures are rudimental and isolated; the cross veinlets are absent from the portion of the marginal area preceding the pterostigmatic region, as well as from the terminal margin, but are numerous elsewhere in advance of the anal (8) nervure, although obsolescent in parts. The intercalar neuration of the anal-axillar interspace of the same wing is less scanty in larger specimens than in the small example figured; but the series of adults available for comparison is too limited for descriptive purposes. Forceps-limbs of ♂ 3-jointed; the proximal joint stout, tapering distally from the base, and rather longer than the slender second joint; terminal joint short and small. Forceps-basis entire, and seemingly very short; ventral lobe of ♀ segment 9 obtusely rounded off and entire. Penis-lobes linear or subulate, and contiguous. Median caudal seta aborted; outer setæ about twice as long as the ♀ body. Tarsal ungues each unlike the other in every leg. Fore tarsus shorter than the ♂ tibia; its joints in diminishing sequence rank 2, 3, 5, 4, 1; the other proportions of the legs are unascertainable.

Nymph unknown.

Type. T. tristis (in *Cloë*), Hag.

Distribution. Ceylon.

Etymology. τέλος and γαρώδης, in allusion to the wings becoming clear and bright in the imago. The type was named *tristis* from the dinginess of the wings of the subimago,—heretofore the only grade described.

Teloganodes tristis, Hagen. Plate XV. 24 *bis* (wings).

Cloë tristis,! Hag., Verh. zool.-bot. Gesells. Wien, viii. 476 (1858); Etn., Trans. Ent. Soc. London (1871), 131, note.

Leptophlebia [Etn.] *tristis*, Hag., *op. cit.* (1873), 394.

Teloganodes [type] *tristis*,! Etn., Ent. Mo. Mag. xviii. 208 (1882) [undescribed].

Subimago (*dried*), ♀.—Wings translucent, taleose, deep warm-sepia brown verging upon sooty black; neuration sometimes like-coloured, but at others many of the longitudinal nervures are black: the pterostigmatic space of the fore wing contains about 9 nearly straight simple cross veinlets at some distance from the bulla. Legs pale, sublutescent varied with piceous; the fore femur, the base and a subterminal band or spot of the fore tibia, and the terminal joints, ungues, and the extreme apical borders of the other joints of all the tarsi, besides the apical projections of the hinder femora, pitch-brown; the apical spinule, and a streak along the upper terminal border of every coxa black. Setæ pale sepia-grey, with black joinings. Abdomen discoloured; thorax pitch-brown; oculi during life (*teste* Nietner's MS. ticket) black.

Imago, ♀ (*dried*).—Wings transparent, very faintly tinted with extremely pale smoke-grey: longitudinal nervures (excepting near the wing-roots), the extreme edges of the wing, and the cross veinlets of the pterostigmatic space of the fore wing, black; wing-

roots piceous. Abdomen piceous with opaque joinings. Setæ brownish- or greyish-white, with deep-black joinings. Length of body, ♀ 5–6; wing 8–8·5; setæ, im., upwards of 15 millim.

Hab. Rainbodde, Ceylon, at upwards of 4000 ft. altitude. An adult ♂ in the British Museum, perhaps of this species, captured in Ceylon by Mr. G. Lewis, was noted by him as luminous at night. Being carded, it cannot well be described.

TELOGANODES MAJOR, sp. nov.

Subimago (*dried*), ♀.—Wings very similar to those of *T. tristis*; neuration concolorous with the membrane, the longitudinal nervures opaque; the pterostigmatic space of the fore wing contains upwards of 14 nearly straight, simple cross veinlets. Legs varying in colour, perhaps with age; fore femur pitch-black or pitch-brown; hinder femora pitch-brown or deep luteo-fuscous, with a dark longitudinal median streak; fore tibia lutescent; hinder tibiæ dull testaceous; tarsi either entirely blackish, or else only the terminal joint and ungues blackish. Body discoloured; setæ light sepia-grey, with black joinings. "Oculi during life red" (*teste* Nietner, MS.). Length of body, ♀ (*shrunken*) 8; wing 10–12; setæ about 25 millim.

Hab. Rainbodde, Ceylon, at an altitude of 4000 ft. and upwards. Two examples (Nos. 17 & 18) in Dr. Hagen's collection, and one (mistaken by me for *T. tristis* in 1871 [Trans. Ent. Soc. London, 1871, p. 131 note]) in the British Museum.

Third Series of Group II. of the Genera.

Adult.—The anal (8) and second axillar (9^2) nervures, together with the margin of the fore wing, enclose a trilateral space, truncate or abrupt at its apex, and curved at the sides; anal nervure either contiguous with, or nearly approximated to, a pobrachial (7 or 7^1) nervure at the wing-roots; first axillar (^{19}) curved or arched, sometimes falling short of the wing-roots. Hind wings absent, or small (*fide* Vayssière), with the costa sharply angulated near the base, and the subcosta nearly straight. Thoracic spiracles relatively small, usually open in dried specimens; orifice of the metathoracic spiracle oval; that of the mesothoracic spiracle angular and short, without a guard, its upper lip convex externally, vaulted within, much larger than the lower lip, and with its edge bent almost at right angles in the middle. Forceps-limbs sessile upon the segment, at the sides of a large immovable lobe, which is represented by a lamina in the ♀. Eyes alike in both sexes, evenly contoured, round or oval, small and far apart. *Subimago* restless until the moulting is imminent, which is speedily effected within a few minutes of the preceding ecdysis, when not retarded by torpor induced by exposure to cold.

This series of genera has affinity with the sections typified by *Ephemerella* and *Polymitarcys*. It is conveniently grouped with the former on account of the character of the nymphs of the section of *Cænis*. Where these differ essentially from those of the two sections already mentioned, they resemble nymphs of the section of *Leptophlebia*.

Their relationship to the section of *Polymitarcys* is traceable in the imago, viz. in the formation of the head, the sexual disparity in the proportional length of the setæ, the

texture of the wings and approximation of the anal (8) to the pobrachial (7) nervure at the base of the mesothoracic wing, and the brevity of the subimago period. The pronotum of the adult, similar in some respects to that of *Ephemerella*, has also an appreciable likeness to that of *Lachlania* and its allies; and it is noteworthy that free epinotal prolongations of the membrane continued from the wing-roots along the hind margin of the mesonotum, similar to theirs, exist in *Leptohyphes*—*Lachlania* and its kindred ranking next to the section of *Polymitarcys*, in the present system of arrangement. In marshalling European collections I have sometimes placed *Cænis* between *Oligoneuria* and *Polymitarcys*; and I believe Dr. Hagen and Mr. M'Lachlan are disposed to assign it that position.

But, on the other hand, at the present time no genus unquestionably referred to Group I. is known to have palpi conformable to the *Leptophlebia* type. Even *Jolia*, so similar in aspect to nymphs of the *Baëtis* and *Siphlurus* sections, has palpi of the *Palingenia* type; and *Euthyplocia*, while deviating slightly from the normal, clearly maintains through *Ephemera* a close connexion with the same group. If the transfer has to be effected eventually, on account of anything learned about nymphs yet to be discovered of genera in Group I., the consequent disturbance in the grouping of the sections may attain very considerable dimensions.

Section 7 *of the Genera.*—Type of *Cænis*. *Adult.*—Pronotum of ♀ transverse and short, closely appressed to the mesonotum, prominent and somewhat smooth above, and with a deep sinus in the middle of its hinder border. Hind tibia about $\frac{2}{3}$ as long as the femur, the tarsus little more than $\frac{1}{2}$ as long as the tibia. In the mesothoracic wing the longitudinal neuration is fully developed; the first and second axillary nervures (9^1 & 9^2) enclose a narrow space, which for some distance from the inner margin maintains an almost even width, and does not extend to the wing-roots; wing-membrane ciliated along the inner and terminal margin, as in the subimago [except, perhaps, in *Leptohyphes*]. Hinder ocelli unusually large; the foremost extremely small [excepting, perhaps, in *Tricorythus maximus*]. *Nymph* [*Leptohyphes* unknown].—Terminal margins of the wings free [excepting, probably, in *Leptohyphes*]. Palpus of the 1st maxilla 3-jointed, longer than the lacinia; the latter crowned with a sparse tuft of hair, armed with spinous teeth at the tip, and ciliate on the inner edge. Lobes of the labium well developed, subovate, nearly as large as the laciniæ of the 2nd maxillæ, which are ovate and acute. Abdominal tracheal branchiæ on segments 1–6; those of the first segment minute and erect; those of the 2nd segment elytroid, shielding the remainder, and differing from all the others in form and texture. Hinder lateral angles of the segments more or less prolonged. Natation laboured, aided by movements of the legs.

Nymphs of two genera in this section are known—*Cænis* and ? *Tricorythus*. *Cænis* has plumose caudal setæ, sparingly branched fringes to the hinder tracheal branchiæ, and has no appendages beneath their laminæ. The other nymph has the setæ minutely pubescent and setulose, like those of *Ephemerella*, laxly pectinate fringes to the obtected tracheal branchiæ, and an appendage on the underside of each lamina of the hinder pairs.

TRICORYTHUS, Etn. 1868.

Illustrations. *Adult* (details), Pl. XV. 25; (whole figure) see citations of Savigny and Pictet under *T. varicauda.* *Nymph* (?), Pl. XLI.

Adult.—Hind wings absent. Caudal setæ 3, mutually subequal in length, about as long as the body in ♀, and twice as long in ♂. Cross veinlets multiserial, numerous in the midst of the wing and of the marginal area (but rudimentary in the latter), remote from the terminal and inner margins; these margins are devoid of isolated rudiments of veinlets, and the longitudinal nervures of branchlets. The anal-axillar interspace contains two well-developed intercalar nervures; the nearest to the anal (8) nervure describes a simple curve, and meets the first axillar (9^1) at a point nearly in a line with the junction of the branches of the pobrachial (7) nervure, and of the sector (4) with the cubitus (5), and at a distance from the inner margin of about $\frac{3}{7}$ of the interval between its own extremity and the costa; the hinder intercalar meets the anterior near its inward termination, and its extremities are curved slightly in opposite directions, somewhat like the stem of an italic *f*; hence the intercalars simulate a deeply forked nervure annexed to the first axillar. The recurrent membrane of the wing-roots does not extend beyond the point of the scutellum. Ventral lobe of ♀ segment 9 obtuse. ♂ unknown to me; proportions of legs unascertained. *Nymph* [*Cænis maxima*, Joly, is perhaps a *Tricorythus* and is provisionally described as such, pending identification].—Body broadest at the mesothorax; head slightly narrower than the pronotum, and somewhat similar in contour to that of an *Ephemerella.* Pronotum quadrangular, oblong, with sharply defined angles. Abdomen slender in comparison with the anterior portion of the body, broadest about the 4th segment, and tapering slightly posteriorly, but nearly as broad in front; segments 2–5 combined are about $\frac{1}{2}$ as long as the posterior segments united; dorsum arched, venter slightly convex; pleuræ somewhat dilated, and similar in character to those of *Ephemerella,* but less obviously ciliated, their hinder angles acute in the anterior segments, but gradually more and more prolonged and acuminate in the posterior segments. Dorsal tracheal branchiæ issue from the antero-lateral angles of the 1st segment, from the posterior margins at the bases of the pleuræ of segments 2–5, and from the disk of the 6th segment at a point in line with the insertions of the four preceding; those of segment 1 [*teste* Vayssière], lost in examples examined by me, are minute, subulate, hirsute, jointed close to their insertion, and erect; those of segment 2, large, elytroid and coriaceous, obtect the hinder pairs completely, and are hitched together by the adjacent inner edges, where a row of short stiff ascending hairs inserted along the margin of the right elytron is caught by a flange projecting from beneath the margin of the left elytron; moreover the same elytroid laminæ are securely held down anteriorly by the hind margin of the segment, which is bevelled or under-cut to receive their front edge and has a small projecting triangular tooth in the middle, affording further support; each elytron, subquadrate in the main, with the outer side and the angles adjacent there rounded off, is externally convex and nude, ciliated with hairs of peculiar form along its outer and terminal margins, and is traversed obliquely by a ridge running from the place of attachment towards its inner posterior angle; each on the underside is largely concav

and supports a short lax filiformly dissected appendage, projecting diagonally from the point of attachment into the concavity. The other tracheal branchiæ are smaller, closely imbricated, decumbent, pergamentose, ovate-triangular, concave beneath, and fringed with crowded, long, unilaterally branched, lax filamentose fimbriæ; and [*teste* Vayssière] each of them shelters in its concavity a filamentosely dissected appendage. Caudal setæ about $\frac{2}{3}$ as long as the body, rather similar to those of *Ephemerella* in the quality and disposition of their hairs, but lacking pilosity. Various parts of the body are beset with peculiar hairs resembling those of *Ephemerella* and Trombidiid *Acarina*. Hind leg the longest, the tarsus (claw excluded) about $\frac{3}{5}$ as long as the tibia; fore tarsus nearly as long as the fore tibia. Antennæ of moderate length, subulate, almost nude.

Type. *T. varicauda* (in *Cœnis*), Pict.

Distribution. Upper Egypt and Cape of Good Hope; also (undescribed sp.) the Malay Archipelago. The nymph described inhabits the south of France.

Etymology, τρικόρυθος, with triple plume.

Tricorythus varicauda, Kollar, MS.

Ephemera [Savigny, Descript. de l'Egypt. Hist. Nat. i. 194 (Explic.), ii. Névropt. pl. ii. 6, 7 (1817)].

Cœnis varicauda, Pict., Hist. Nat. Névropt. ii. Ephém. 281, pl. xliii. 5 (1843–5); Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 581 (1853).

Tricorythus varicauda, Etn., Ent. Mo. Mag. v. 82 (1868); *id.*, Trans. Ent. Soc. London (1871), 92, pl. ii. 3, 3*a* [wing, after Savigny].

Adult (*dried*), ♂.—Body pale yellowish; eyes and a spot on the frons black. Mesothorax rather darker laterally, with some longitudinal black marks [sutures ?]. The last five segments of the abdomen have each a black dot ("point") above. Setæ white, finely annulated with black. Legs yellowish, with some greyish clouds. Wings and neuration slightly yellowish, except the subcosta and radius ("la costale et la sous-costale"), which are rather darker, without being quite so dark as in *Cœnis argentata* and *C. halterata*. Length of body, ♂ 4, expanse of wings 10, length of setæ 9 mm.

Hab. Upper Egypt. [After Pictet.]

Tricorythus discolor, Burmeister.

Oxycypha discolor, Burm., Handb. d. Ent. Bd. ii. Abth. ii. 797 (1839).

Cloëon discolor, Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 577 (1853).

Cœnis discolor, Etn., Trans. Ent. Soc. London (1871), 96; ! Hag., *op. cit.* (1873), 399 [*C. albida*, Winthem, MS.].

Subimago (*dried*), ♀.—Head dull dark grey above; pronotum greyish fuscous, meso- and meta-notum dull lutescent or brown-ochre; dorsum of abdomen dark cinereous, venter and eggs ochraceous; setæ white, pubescent. Wings throughout very pale sepia-grey, translucent; longitudinal nervures subopaque, slightly brownish; cross veinlets very indistinct; the darkened appearance of the costal border is due merely to the subcosta and radius being closed together by shrinkage of the membrane. Legs pale flavescent; the fore-femur edged with fuscous, the tibia and tarsus dark sepia-brown. Length

of body, ♀ (eggs discharged, and therefore shrunken) about 5·7; wing 10; setæ about 8–9 mm.

Hab. Cape of Good Hope (Burm.). Described from a specimen in Dr. Hagen's collection (Winthem). The comparative elongation of the wings noticed by Dr. Hagen (1873) is doubtless due to the sex of this example.

Tricorythus (?) sp. (nymph). Pl. XLI. (whole figure and details).

Cœnis or *Cœnis maxima*, Joly, Bull. Soc. Hist. Nat. Toulouse, iv. 144, pl. —? (1870); *id.* Rev. d. Soc. Savants, ser. 2, iii. 69–72 (1873); *id.* Feuil. d. jeun. Nat. ann. 6, 53–4, pl. ii. 7 (1876); ! Etn., Ent. Mo. Mag. xvii. 196 (1881).

Tricorythus, ! Vayssière, Ann. d. Sc. Nat. 6ᵉ sér. Zool. xi. 3, 4, pl. i. 1 (1881); *id.*, *op. cit.* xiii. 65, pls. vi. 54, viii. 81–90 *bis*, & ix. 94–97 (whole figure and details).

Adult unknown.

Nymph of mature age; length of body 10, outer setæ 7 mm.

Hab. The Garonne near Toulouse (Dr. E. Joly). I am disposed to suspect that this nymph has been too hastily referred to *Tricorythus*; the adult may be of a genus at present unknown; but I could not distinguish the neuration of the wings satisfactorily in the nymph, and therefore this is only a conjecture.

LEPTOHYPHES, Etn. 1882.

Illustrations. *Adult* (detail), Pl. XV. 25 *bis*.

Adult, ♀.—Hind wings absent. Caudal setæ 2, about as long as the wings. Cross veinlets multiserial, numerous in the larger portion of the wing, but absent from the marginal area and from the vicinage of the terminal and inner margins; these are devoid of isolated rudiments of veinlets and perhaps of fringes, and the longitudinal nervures have no branchlets at their terminations. The anal-axillar interspace contains two well-developed intercalar nervures, each of which, like the 1st axillar (9^1), is met at its anterior extremity by two cross veinlets,—one from each of the nearest adjacent nervures; the anterior of these intercalars is a little the larger, nearly straight, and is connected by several obsolescent cross veinlets with the anal (8) nervure, to which it is subparallel; the hinder intercalar is almost imperceptibly curved, nearly bisects the area intervenient between the first intercalar and the first axillar nervures, and is connected more strongly with the former of these than with the latter. The recurrent membrane of the wing-roots projects as a subulate point beyond the peak of the scutellum. Other particulars unascertained. ♂ unknown.

Type. L. eximius, Etn.

Distribution. Argentine Republic.

Etymology. λεπτοϋφής, finely woven; referring to the tenuity and relative abundance of cross veinlets.

Leptohyphes eximius. Pl. XV. 25 *bis* (wing).

Leptohyphes eximius, ! Etn., Ent. Mo. Mag. xviii. 208 (1882, Feb.).

Adult (*dried*), ♀.—Body discoloured dull pitch-black. Wings talcose, transparent,

slightly dimmed with very light sepia-greyish; neuration pitch-brown. Fore legs and hinder femora greyish black; hinder tibiæ and tarsi greyish white. Setæ dull whitish. Length of body (shrunken) 4; wing 8; setæ about 8 mm.

Hab. Cordova, Argentine Republic (Mus. Comp. Zool. Cambridge, Mass.).

CÆNIS, Steph. 1835.

Illustrations. *Adult* (details), Pl. XV. 26 *a*, *b*; (whole figures) Steph. (1835) under *C. halterata* (*macrura*), and Pictet under *C. halterata* (*grisea*) and *lactella* (‡ *lactea*). *Nymph*, Pl. XLII.

Adult.—Hind wings absent. Caudal setæ 3, mutually subequal, the median being sometimes a little longer or shorter than the others, which in ♂ im. are from $3\frac{3}{4}$ to 5 or 6 times as long as the body, and in ♀ about $\frac{3}{4}$ as long as it; in neither sex are the setæ of the subimago much more than $\frac{1}{2}$ as long as the body, and therefore their joints in the ♂ undergo excessive elongation during the last moult; in ♂ im. they are uniformly glabrous, but in ♀ im. the setæ are pubescent from near their roots to the tips. Cross veinlets almost exclusively uniserial, remote from the margin and absent from the marginal area; terminal and inner margins of the wings devoid of rudimentary veinlets; no branchlets to the longitudinal nervures. The anal-axillar interspace contains two long intercalar nervures of nearly equal length, either of which is met by the other just before annexing itself to the anal (8) nervure near the series of cross veinlets, and at a distance from the inner margin of about $\frac{3}{5}$ of the interval between its own extremity and the costa; the fork formed by their conjunction is narrow and deep, and the curvature of its sides nearly uniform. The recurrent membrane of the wing-roots does not extend beyond the scutellum. Homologue of the forceps-basis undeveloped in ♀. Pleuræ prolonged posteriorly in segments 7, 8, and 9 of the abdomen into setaceous-acuminate or subulate teeth. Forceps-basis entire; forceps-limbs jointless and short; penis exposed, undivided, without apparent stimuli. Ungues of the hinder tarsi of ♂, and of all the tarsi of ♀, each unlike the other; those of the ♂ fore tarsus alike, rotund. Fore tarsus of ♂, exclusive of joint 1, about $\frac{2}{3}$ as long as the tibia, which is about twice as long as the femur; its joints in diminishing order rank 2, 3 subequal to 4, 5; joint 1 is not distinctly marked off from the basis. Fore tarsus of ♀ 4-jointed, about $\frac{2}{3}$ as long as the tibia; this and the proximal joint of the former together are very little more than $\frac{3}{4}$ as long as the femur. Hind tarsus ♀ $\frac{4}{7}$ as long as the extreme length of the tibia; its joints rank 4 (the terminal), 1, and 3 subequal to 2. The theoretical first joint in these tarsi is undeveloped; the femora are relatively broad. During quiescence the *subimago* stands upon all its feet, with the caudal setæ laid together, and the wings usually widely outspread, rarely erect. *Nymph.*—Body broadest at about the mesothorax, but not so in a marked degree; head a little narrower than the pronotum, varying slightly in contour with the species. Pronotum transverse, its lateral borders sometimes dilated, and prolonged somewhat in front. Abdomen narrowed gradually in its hinder half, the anterior segments differing little from one another in breadth; 1st ventral segment thoracoid, 2–5 shorter than the succeeding segments; ventral segments 2–6 together about as long as 7–10 together; pleuræ dilated, posteriorly acute or acuminate. Tracheal branchiæ

placed as in *Tricorythus maximus*, and of a very similar character, but the laminæ of the hinder pairs are more rounded in form, and are not provided with an appendage on their under surface. Moreover the elytroid pair are beset with short pubescence on the upper surface, and ciliated with fine hair along their lateral and posterior borders; the pairs succeeding them are membranaceous, and their fringes are subdivided more sparingly than in *Tricorythus*, the fibrils of the costal border and of the proximal portion of the inner border of each lamina being simple or only bipartite, instead of pectinate, and those of the distal margin having only two or three short branches apiece, arranged unilaterally. Caudal setæ about $\frac{3}{5}$ as long as the body, beset at the joinings with fine rigid hair arranged pinnately. The hairs of *Cænis* are not flattened like those described under *Tricorythus*. Hind leg the longest; the tarsus (claw excluded) about as long as the tibia. Femora slender, or broad, according to the species. Antennæ of moderate length; joint 2 rather long and pubescent; the remainder of the flagellum beset at the joinings with minute spreading hairs.

Type. *C. halterata* (in *Ephemera*), Fab.

Distribution. Northern Europe and America, southwards to Egypt (Savigny), Mogador (undescribed sp.), and Florida; lakes of East Central Africa; Cape Town (undescribed sp.); and the Indo-Malay region.

Etymology. A mythological proper name.

The adult flies take wing during the cool of the day, and during the warmer hours of the night, when light is attractive to them. Their life is fugitive in dry air. The Cape Town and Mogador species were found there by me in 1874 and 1881 respectively; but in each case only a single drowned adult ♀ was obtained. I have seen nymphs of *C. dimidiata*, *halterata*, *Harrisella*, and of some Portuguese and Italian species alive. My discovery of the nymph occurred at Cambridge in the spring of 1866; but the genus and species (*C. dimidiata*) of the specimen captured were not ascertained until a year or two later.

Cænis dimidiata, Steph. Plate XV. 26.

?*Ephemera minima*, Linn., Syst. Nat. ed. v. p. 62 (1747); Mül., Zool. Dan. Prodr. 142 (1776); Schr., Fn. Boica, ii. pars ii. 198 (1798).—[*Ephemera*] or *E. horaria*, Linn., [Act. Upsal. (1736), p. 27; *id.*, Fn. Succ. ed. i. no. 754 (1746)]; *id.*, Syst. Nat. ed. x. i. 547 (1758); *id.*, Fn. Succ. ed. ii. 376; [Geof., Hist. Abreg. d. Ins. Paris, ii. 240, no. 8 (1764);] Pontop., Naturh. Dan. 223 (1765); Linn., Syst. Nat. ed. xii. pars ii. 907 (1767); Fab., Syst. Ent. 304 (1775); Mül., Zool. Dan. Prodr. 143 (1776); Fab., Sp. Ins. i. 358 (1782); Fourc., Ent. Paris, ii. 352 (1785); Fab., Mant. Ins. i. 244 (1787); Berkenh., Outl. Nat. Hist. Gt. Brit. & Ireland, ed. ii. i. 150 (1789); Vill., C. Linn. Ent. iii. 20 (1789); Gmél., Linn. Syst. Nat. ed. xiii. i. pars v. 2630 (1790); Ros., Fn. Etrusc. ii. 9 (1790); Ol., Encycl. Méth. vi. 419 (1791); Fisch., Vers. e. Naturgesch. v. Livland, 566 (1791); Fab., Ent. Syst. emend. iii. pars i. 71 (1793); Schr., Fn. Boica, ii. pars ii. 199 (1798); Cederh., Fn. Ingricæ Prodr. 135 (1798); Walck., Fn. Paris, ii. 10 (1802); Lat., Hist. Nat. ed. ii. 226 (1817).—*E. plumosa*, Mül., Zool. Dan. Prodr. 142 (1776).—*E.* ‖ *albipennis*, Atkinson, Zoologist, i. 272–5 (1843).—*E. lactea*, Landois, Jahresb. Westf. Prov. Ver. f. Wissensch. u. Kunst. (1878), 3.

?*Brachycercus minima*, Curt., Lond. & Edinb. Phil. Mag. ser. 3 (1834), 122.

Cænis dimidiata, ! Steph., Ill. Brit. Ent. vi. 61 (1835); Pict., Hist. Nat. Névropt. ii. Ephém. 286

(1843–5); Walk., List of Neuropt. Ins. in Brit. Mus. 582 (1853); Hag., Ent. Ann. (1863), 12; Oulianine, Neuropt. & Orthopt. of Prov. of Moscow, p. 27 (1867); ! Etn., Trans. Ent. Soc. Lond. (1871), 95, pl. ii. 4 [ala] & v. 5 [genital. ♂]; Hag., *op. cit.* (1873), 397–9; Mocsáry, Rev. d. Inhalte der Termeszetrajze Fuzetek, ii. 124–5 & [German text] Naturh. Heft ii. Bd. ii. u. iii. 181–2 (1878); Rostock, Jahresb. d. Ver. f. Naturk. Zwickau, 1877, p. 80 (1878).—*C. brevicauda*, ! Steph., Ill. Brit. Ent. vi. 61 (1835); Pict., Hist. &c. 286 (1843–5); Walk., List &c. 582 (1853).—*C. pennata*, ! Steph., Ill. Brit. Ent. vi. 61 (1835); Pict., Hist. &c. 286 (1843–5); Walk., List &c., 583 (1853).—*C. lactea*, Gerstäcker, Handb. d. Zool. ii. 61 (1863); Hag., Stet. Ent. Zeit. xxvi. 229–32 (1865); id., Trans. Ent. Soc. Lond. (1873), 397.

Oxycypha lactea, Burm., Handb. d. Ent. Bd. ii. Abth. ii. 796 (1839).

?*Cloë horaria*, Ramb., Hist. Nat. d. Ins. Névropt. 299 (1842); Pict., Hist. Nat. Névropt. ii. Ephém. 270 (1843–5); Oulianine, Neuropt. & Orthopt. of the Prov. of Moscow, p. 29 (1867).

?*Cloëon horaria*, Walk., List of Neuropt. in Brit. Mus. 576 (1853).

Subimago (*living*).—Wings greyish white, with the marginal and submarginal areas tinted with warm sepia almost to their extremities. Setæ white.

Imago (*living*).—Head and pronotum fuscous, antennæ white. Meso- and metathorax piceous. Abdomen whitish, varied with grey; in ♂ white above, with markings corresponding in position with those of the ♀, but only faintly tinged with grey; in ♀ cretaceous, with segments 1–5, and sometimes the extreme base of 6, grey above, but with this colour broadly interrupted at the joinings by the ground-colour, and widely so in the middle of segment 1; moreover the patches of grey are intersected by a fine longitudinal cretaceous line, and are invaded by the same colour in the neighbourhood of the pleuræ, where a series of grey dots is distinguishable, placed singly in the segments close to their anterior lateral angles; the dots are present also in the hinder segments, which otherwise are uniformly cretaceous. The ventral segments of ♀ are often marked on each side with a grey dot. The ♂ genitalia are pale throughout, and when dried have a light yellowish testaceous tint. Setæ white. Fore leg in some lights tinged with Roman sepia-grey, and with femur simply grey, becoming when dry whitish with the femur bistre- or light sepia-grey in ♀, and greyish or brownish grey in ♂. Hinder legs greyish white (the ♀ with yellowish-white femora when dried), with a black dot on the upper edge of the femur a little before the knee, visible also on the ♀ fore femur. The stronger portions of the longitudinal nervures, and the usual coloured part of the front border of the wings, are greyish in the dried ♂ and sepia-grey in the ♀. Length of body 3–5; wings, ♂ 4, ♀ 5; setæ, ♂ im. 18 & 13, subim. 3 & 2·5–3 & 3·5; setæ, ♀ im. 3, subim. 2·25 millim.

Hab. Great Britain to Moscow, and Scania (Wallengren) to Lago Maggiore, where I have taken it at Pallanza. It abounds in Belgium and Holland, as well as in lowland Switzerland. Pastor Wallengren adopts the prevalent surmise that this was the species which Linné meant to describe as *E. horaria* in 1758. I have not adopted the name (on account of the vagueness of the diagnosis) in the absence of authentic types. Vague diagnoses are, at the most, essentially generical.

Var. RIVULORUM.

Imago (*living*), ♀.—Head and prothorax translucent whitish grey, varied with dark

black-grey. Meso- and metanotum light umber-brown, with black sutures. Abdomen white, segments 1–3 partly shaded above very slightly with greyish. Legs white; the fore coxa, femur, and base of the fore tibia dark grey; hinder femora white.

♂ (*living*).—Similar; meso- and metanotum lighter than in the ♀, and with sutures less distinctly black. Costa, subcosta, radius, sector, and cubitus blackish grey to rather beyond the middle. Length of wing 3, setæ about 12 millim.

Hab. Dorsetshire, in the Syndeford brook, near Shedrick, in the parish of Thorncombe, Chard; also the Dove, near Mayfield, Ashburne, Derbyshire (June). I suspect this is the insect quoted as English by Pictet under *C.* ‡ *lactea* in 1843–5.

Cænis lactella (renamed).

Cænis ‡ *lactea*, Pict., Hist. Nat. Névropt. ii. Ephém. 276, pl. xliii. 1–1 & xliv. (1843–5); Hag., Trans. Ent. Soc. London (1873), 397.

Imago (after Pict.).—Head grey, with the vertex a little lighter. Thorax light ochreous, with the sides of the prothorax and the mesonotum fuscescent; the latter marked with a cruciform spot of the ground-colour. Abdomen white, with very slightly defined spots on the sides of the segments. Setæ whitish. Legs tinged very faintly with lutescent. Wings vitreous, colourless; subcosta and radius black; the other nervures lutescent, colourless in the ♂.

♂ (*dried*).—Vertex of head pitch-brown. Thorax translucent; the pronotum rather greyer than the remainder in some lights; meso- and metanotum pervaded with a light brownish amber-colour, the metathorax viewed sideways rather yellower amber. Terminal segments of the abdomen very light yellowish amber or light brown ochreous; the remainder whitish amber, with traces of the same yellowish colour at the sides of the back; legs and setæ uniformly whitish, or whitish amber with a faint yellowish tint. Length of body, ♀ 4, ♂ (dried) 3; wing, ♀ 4, ♂ 3·5; setæ ♂ 11 millim.

Hab. Lakes of Geneva and Zurich, in the middle of summer. I obtained it at Geneva (1230 ft. alt.) on the 10th August, in profusion at gas lamps. Pictet's fig. 1 is a very good likeness of the living ♂ im.

Cænis halterata, Fab. Pl. XV. 26.

Ephemera halterata, Fab., Gen. Ins. 244 (1777); *id.*, Sp. Ins. i. 384 (1782); *id.*, Mant. Ins. i. 243 (1787); Vill., C. Linn. Ent. iii. 18 (1789); Gmél., Linn. Syst. Nat. ed. xiii. i. 2629 (1790); Ol., Encyc. Méth. vi. 418 (1791); Fab., Ent. Syst. emend. iii. pars i. 69 (1793); Schr., Fn. Boica, ii. pars ii. 198 (1798); Lat., Hist. Nat. Crust. & Ins. xiii. 95 (1805); Zet., Ins. Lap. 1045 (1840); Hag., Trans. Ent. Soc. London (1873), 396.—*E. brevicauda*, Fab., Ent. Syst. emend. iii. pars i. 69 (1793); Walck., Fn. Paris, ii. 9 (1802); Lat., Hist. Nat. Crust. & Ins. xiii. 96 (1805); Zet., Ins. Lap. 1045 (1840).

Brachycercus chironomiformis, Curt., Lond. & Edinb. Phil. Mag. ser. 3 (1834), 122.

Cænis chironomiformis, Steph., Ill. Brit. Ent. vi. 62 (1835); ! Etn., Trans. Ent. Soc. (1871), 94.—*C. macrura*, ! Steph., Ill. Brit. Ent. vi. 60, pl. xxix. 1 (1835); Walk., List of Neuropt. in Brit. Mus. 583 (1853); Hag., Ent. Ann. (1863), 10; ! Etn., Trans. Ent. Soc. London (1868), 279–82 [nymph]; ! *id.*, *op. cit.* (1871), 93, pl. v. 4 [details]; Hag., *op. cit.* (1873), 397; Meyer-Dür, Bull. Soc. Ent. Suisse, iv. 308 (1874); Rostock, Jahresb. d. Ver. f. Naturk. Zwickau, 1877, 80 (1878).—*C. interrupta*, Steph., Ill. Brit. Ent. vi. 62 (1835); Pict., Hist. Nat. Névropt. ii. Ephém. 287 (1843–5); Walk., List

&c. 583 (1853).—*C. grisea*, Pict., Hist. &c. 278, pl. xlv. 1, 2 (1843–5); Walk., List &c. 581 (1853); Brau., Neuropt. Austr. 25 (1857); Ausser., Ann. d. Soc. Nat. Modena, Ann. iv. 133 (1869); ! Joly, Bull. Soc. Hist. Nat. Toulouse, iv. 147 (1871); *id.*, Bull. Soc. d'Et. &c. Angers, 41–2, Note B (1876).—*C. halterata*, ! Hag., Ent. Ann. (1863), 11.

Subimago (*living*).—Wings tinted with greyish, especially towards the costa. Setæ light blackish grey.

Imago (*living*).—♂. Head grey-black, with the stipes of the antennæ and the cervical joining sepia-grey. Pronotum medium ivory-black; meso- and metanotum jet-black, changing to pitch-brown when dried. Abdomen of ♂ grey, tinged towards the sides with medium ivory-black; each dorsal intermediate segment has the track of the dorsal vessel, and a spot on each side of it at the base of the segment, pellucid, and each of those segments beneath has a pellucid spot on each side near the middle; the dorsal joinings of the segments are opaque, with the extreme overlapping edge of the integument whitish. Setæ grey, with light blackish-grey joinings. Legs pitch-black; the tibiæ, tarsi, and under edges of the femora light blackish-grey and translucent. Wings transparent, smoky, slightly greyish in the vicinage of the costa for some distance from the wing-roots; costa, subcosta and radius, and in some lights the other longitudinal nervures pitch-black; but viewed with transmitted light, in some positions, most of the nervures mentioned, excepting the thicker parts of the three foremost, become translucent whitish.

♀ (*living*).—Fore femur grey; hinder femora yellowish white. Abdomen above blackish grey, becoming ochreous towards the joinings and sides of the segments; venter tinged with greenish grey. Length of body, ♂ 4–5, ♀ 6; wing, ♂ 4–5, ♀ 7; setæ, ♂ im. 14 & 15–15 & 16, subim. 3; ♀ im. & subim. 2–3 millim.

Hab. Europe, from Scania and Småland (Wallengren) or Lapland (Zet.) to Portugal and Italy; and from Great Britain to Germany and Switzerland. Abundant at Cintra, 27th April (400–600 ft.); Toulouse (430 ft.); Bâle and Geneva; and near San Marcello, in the Apennino-Pistojese (2200 ft.). The form of the spot on the forceps-basis varies considerably in dried examples, and sometimes the spot disappears in drying.

Cænis robusta, sp. nov.

Imago (*dried*), ♂.—Thorax lucent raw-umber or light pitch-brown, the pronotum rather paler laterally, the vertex of the head rather redder brown, approaching light burnt-umber. Abdomen greyish white above; the joinings very narrowly grey-black, bordered narrowly with whitish at the bases of the segments; the dorsal vessel and the sides of the dorsal segments pale, the lighter space encroaching largely upon the darker in segment 7; genitalia stained slightly with brown-ochreous; venter and forceps-basis uniformly whitish; setæ white. Legs whitish; fore femur and base of fore tibia varied with sepia-grey; ungues and hinder femora whitish yellow-amber. Wings transparent, slightly smoky along the costal margin; costa, subcosta, and radius for some distance from the wing-roots dark sepia-grey.

♀. Head and thorax rather similar in colour to those of the ♂. Abdomen opaque with light greyish dorsal markings (dark grey in the subimago) upon a dull light brown-

ochreous ground-colour, of a similar pattern to those of the ♂. Setæ white. Legs nearly as in ♂, but in some lights the fore tibia and tarsus appear sepia-grey. Length of body, ♂ 4, ♀ 6; wing, ♂ 4, ♀ 6; setæ, ♂ im. about 15, subim. 2·5 & 3–3 & 4, ♀ im. 4–5, subim. 3 & 4 millim.

Hab. Holland, the Ijssel, near Gouda, by the nearest lock on the way to Stein; end of July.

Cænis Harrisella, Curtis.

Brachycercus Harrisella, Curt., Lond. & Edinb. Phil. Mag. ser. 3 (1834), 122.

Cænis Harrisella, Steph., Ill. Brit. Ent. vi. 61 (1835); Pict., Hist. Nat. Névropt. ii. Ephém. 286 (1843–5); Walk., List Neuropt. in Brit. Mus. part iii. 583 (1853).—*C. luctuosa*, Pict., Hist. &c. 283, pl. xlv. 3 (1843–5); Walk., List &c. 582 (1853); Hag., Stet. Ent. Zeit. xxvi. 229 (1865); ! Etn., Trans. Ent. Soc. Lond. (1871), 97, pl. v. 6 [forceps]; Hag., Trans. Ent. Soc. Lond. (1873), 399; Meyer-Dür, Bull. Soc. Ent. Suisse, iv. 308 (1874); Rostock, Jahresb. d. Ver. f. Naturk. Zwickau, 1877, p. 79 (1878).—*C.* ‡ *halterata*, ! Etn., Trans. Ent. Soc. Lond. (1868), 279–81 [nymph].

Oxycypha luctuosa, Burm., Handb. d. Ent. Bd. ii. Abth. ii. 797 (1839).

Ephemera ‡ *brevicauda*, Blanch., Hist. Nat. des Ins. iii. 54 (1840).

Subimago (*living*).—Head and pronotum greyish black; meso- and metanotum black. Abdomen light brown-ochre or light cinnamon; setæ black. Wings tinted with blackish grey; their neuration dark. Legs white, sometimes smoky white; the tarsus, tibia, and extremity of the femur of the fore leg carbonaceous black.

Imago, ♀ & ♂ (*living*).—Head and thorax pitch-black, with the sutures and pleuræ of the latter Roman sepia-brown. Abdomen Roman or warm sepia-brown, with a short dark line on each side at every joining, and pale elongated spots near the bases of the setaceous pleural prolongations of segments 7–9; forceps and setæ grey or light blackish grey. Wings whitish, with grey nervures, excepting the piceous subcosta and radius. Fore tarsus warm sepia; hinder legs light blackish grey, with the joinings black. Length of body, ♂ 6·5, ♀ 5–7; wing 5·5–6; setæ, ♂ im. 25, subim. 4, ♀ subim. 3 & 4 millim.

Hab. England, in the Kennet, near Reading, and in Somersetshire; Berlin (Burm.); St. Petersburg (Hag.); Lake of Thun (Pict.). The nymph is easily recognized by its strangely subconical ocelli: on one occasion I caught one in the part of the Garonne flowing between St. Michel and the Île des Grands Ramiers, Toulouse. It probably flies by night.

Cænis oophora, Kollar MS.

Cænis oophora, Pict., Hist. Nat. Névropt. ii. Ephém. 284, pl. xlv. 4 (1843–5); Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 582 (1853); Etn., Trans. Ent. Soc. London (1871), 97.

Adult, ♀ (*dried*).—Brilliant brown; legs lutescent, spotless. Wings whitish, with their neuration more distinct than in ordinary species of *Cænis*, and the radius stouter and darker. Length of body 4; expanse of wings 11 millim.

Hab. Sardinia (after Pictet). Described from a defective ♀ example.

Cænis argentata, Kollar MS.

Cænis argentata, Pict., Hist. Nat. Névropt. ii. Ephém. 279, pl. xliii. 6 (1843–5); Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 581 (1853); Etn., Trans. Ent. Soc. London (1871), 96.

Subimago (*dried*), ♀.—More delicate and slender than *C. halterata* and *C. lactella*. Head and thorax grey, with silvery reflections, the prothorax a little lighter. Abdomen grey at the base and brilliant white at the tip. Fore legs grey; hinder legs brilliant white. Setæ white, faintly annulated with blackish. Wings slightly greyish, the subcosta and radius black. Length of body 4, setæ 3; expanse of wings 8 millim.

Hab. Sicily (after Pictet).

Cænis hilaris, Say.

Ephemera hilaris, Say, Journ. Acad. Nat. Sc. Philad. viii. 43 (1839); Le Conte, Complete Writings of T. Say, ii. 413 (1859).

Cænis hilaris, Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 583 (1853); Hag., Smithson. Miscell. Coll. (1861), Synop. Neuropt. N. Am. 54; Walsh, Proc. Acad. Nat. Sc. Philad. (1862), 381; Hag., Proc. Ent. Soc. Philad. ii. 179 (1863); Etn., Trans. Ent. Soc. London (1871), 96.

Imago (abstract after Say).—Thorax pale fulvous. Abdomen white; each of the apical segments with three fuscous dots on each side. Length of body 2 millim.

Hab. Indiana; September.

Cænis diminuta, Walk.

Cænis diminuta, ! Walk., List of Neuropt. Ins. in Brit. Mus. part. iii. 581 (1853); Hag., Smithson. Miscell. Coll. (1861), Synop. Neuropt. N. Am. 55; ! Etn., Trans. Ent. Soc. London (1871), 95.—*C. amica*, Hag., Smithson. Miscell. Coll. (1861), Synop. Neuropt. N. Am. 55.

Imago (*dried*), ♂.—Thorax above for the most part bronzy brown-ochreous. Abdomen whitish, varied with grey anteriorly on the back, posteriorly yellowish white; the joinings of the segments and a dark longitudinal line near the spiracular border on each side of the back in the intermediate segments black. Genitalia and setæ white. Wings transparent whitish grey; the subcosta and radius purple-black to beyond the middle. Legs whitish: the fore femur warm sepia-grey, with a dark spot above close to its distal extremity: hinder femora dull whitish, with a grey band or a black spot on their upper part just before the knee. Length of body, ♂ 2–2·5, wing 3, setæ 10 millim.

Hab. St. John's Bluff, East Florida (E. Doubleday; Brit. Mus.); Pennsylvania (Zimmermann; Berlin Mus.). By using a lens of suitable power, instead of a Coddington, I can distinguish the femoral spots or bands in Walker's type, which formerly were supposed by me to be lacking, but were mentioned by Hagen in his description of *C. amica*. He indicates perhaps a distinct species from the same locality (Pennsylvania) in the Berlin Museum, with a yellow thorax, whitish yellow abdomen, and white legs, grey at the distal extremities of the fore femur and tibia.

I have seen several other N.-American species of *Cænis*, but have left them to be described by entomologists resident in that country.

Cænis perpusilla, Walk.

Cænis perpusilla, ! Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 585 (1853); Hag., Verh. zool.-bot. Gesells. Wien, viii. 477 (1858); ! Etn., Trans. Ent. Soc. London (1871), 96.

Imago (*dried*), ♂.—"Testaceous;" wings transparent, the marginal and submarginal

areas, from the base of the wing to beyond the middle, faintly tinged with light grey; the subcosta and radius black. Hinder legs and setæ white. Length of body 2·5; wing 3; setæ 12 millim.

Hab. Ceylon (Brit. Mus.). The above is hardly an adequate description of the species, and therefore the name may rank as a mere catalogue name. The unique specimen is gummed upon card, back downwards, and consequently little can be added to Walker's diagnosis.

Cænis cibaria, Etn.

Cænis cibaria, ! Etn., Ent. Mo. Mag. xv. 268 (1879).

Imago (*dried*).—Head black, grey above. Thorax light bistre-brown, with the sutures and point of the scutellum black, and the metanotum, as well as the first abdominal segment, grey, with their distal borders black. Abdomen of ♂ in segments 7–10, and of ♀ throughout blackish grey, with the joinings and sides of the dorsum widely whitish, and with segments 2–6 of ♀ less dark; these segments are whitish in ♂, and so also, sometimes, is the track of the dorsal vessel in the dark segments; venter uniformly pale. Legs whitish; the outer side of the coxæ, and a large triangular preapical spot or abbreviated streak on the upper part of the femur black. Wings vitreous, with the coarser nervures and the interjacent cross veinlets more or less opaque blackish-grey. Length of body, ♂ 2·5–2·75, ♀ 4·0; wing, ♂ 2·0–2·75, ♀ 3·0 millim.

Hab. In company with *C. kungu*, 25th January, 1877 (H. B. Cotteril).

Cænis kungu, Etn.

Cænis kungu, ! Etn., Ent. Mo. Mag. xv. 268 (1879); *cf.* Elton, Travels . . . East. & Cent. Africa, p. 292 & Append. p. 415 (1879) [no descript., but note of habits].

Imago (*dried*).—Head and thorax light brown-ochre, or furfuraceous above, and very light yellow-ochre beneath; abdomen yellower, with the joinings pale. Femora brown-ochreous, the fore tibia of ♂ light blackish-grey, the tarsi and hinder tibiæ whitish. Wings vitreous, in ♂ very faintly tinted towards the costa with light warm sepia-greyish; the costa and a few of the neighbouring nervures, with the intervening cross veinlets, pitch-black, becoming with change of light warm sepia-brown where they are thinnest. Length of body, ♂ about 3·5, ♀ 4·5–5·0; wing, ♂ 3, ♀ 3·5–3·75; setæ, ♂ subim. 1·75 millim.

Hab. Lake Nyassa, about the middle of the lake, between Livingstonia and Makanjeras, 25. i. 1877 (H. B. Cotteril). The packet containing specimens of this and *Cænis cibaria* (*supra*) was endorsed "Edible midges, which the natives of Nyassa make into cakes," sold in their markets by the name of "Kungu." The specimen of Kungu examined by me was composed almost exclusively of a species of the *Culicidæ*; and therefore it is probably made of whatever mild-flavoured insect happens to be in sufficient profusion at the place and time of its manufacture.

Section S *of the Genera.*—Type of *Prosopistoma*. *Adult.*—Similar to *Cænis* and its allies, but with 4 wings instead of 2 only. Figured by Vayssière under very disadvantageous circumstances; the figures consequently do not admit of exact comparison. *Nymph.*—Fore wings immersed in a notal shield, which conceals the tracheal branchiæ and most of the abdomen: pronotum undefined. Palpus of maxilla 1. 4-jointed, longer than the lacinia; the latter nude on the crown, armed with a few strong spinous teeth at the tip and a few setulæ on its inner side. Labium not differentiated into lobes and laciniæ of second maxillæ. Hinder lateral angles of abdominal segments dilated and produced. Natation agile, effected by the setæ exclusively (which are capable of complete retraction into the interior of the abdomen), the legs being closely folded up.

PROSOPISTOMA, Lat. 1833.

Illustrations. *Subimago* (details), Pl. XV. 27 (after Vayssière, 1881). *Nymph*, Pl. XLIII.; see also citations under *Binocle*, Geoffroy (1764), *Prosopistoma*, Joly (1872, Sept., and 1876 Mars), Westwood (1877), and Vayssière (1881).

Subimago (in alcohol).—Wings 4; hind wings with the costal shoulder placed close to the wing-roots; neuration in both wings plentiful, but no cross veinlets are delineated. Hinder ocelli relatively much smaller than in *Cænis*. Abdomen proportioned somewhat as in *Cænis*, with the pleuræ of segments 7-9 similarly produced into slender points; the ventral lobe of ♀ segment 9 entire and truncate. Caudal setæ of ♀ $\frac{1}{5}$ as long as the body. The recurrent membrane of the fore wing-roots does not extend beyond the point of the scutellum. ♂ and adult fly unknown. Proportions of legs not ascertained (after Vayssière, 1881). *Nymph.*—Broadly ovate, tapering posteriorly, flattened beneath, and highly convex above. Notal shield imperfectly peltate, being excised in front and behind to fit with extreme exactitude the adjoining surfaces of the head and 7th abdominal segment; laterally its borders are broadly expanded, flattened beneath, and truncate obliquely in front and behind; dorsally, along the median suture, a narrow depression or shallow furrow is apt to be produced, the integument thereabout being apparently of a texture sufficiently yielding and elastic to allow considerable variation in the definition of the furrow. Possibly this part may be concerned in some way with the transfusion of water through the branchial chamber underlying the shield; but this is merely my conjecture. At the hinder extremity of the median suture, a small aperture is discernible at the edge of the shield, affording an exit from the branchial chamber. The plastron (so to speak) truncate in front and behind, and narrowed in advance of the metasternum, is slightly countersunk in relation to the sternum and traversed by shallow grooves for the lodgment of the legs when they are folded up during adhesion or natation. The sutures of the mesosternum, with the pro- and meta-sterna, are liable to become effaced in alcoholic specimens; neither the artist nor myself could distinguish them in the subject of Pl. XLIII. The sternum terminates behind in an acuminate point, very near the margin of the plastron, and has a very smooth flattened surface. A narrow ovate aperture exists on each side of the plastron close to the acute hinder angles;

through these inlets the water enters the branchial chamber. Head transverse, flattened beneath, arched in front and above. Labrum small. Mentum oblong-oval, crenulated behind, and with a truncate-triangular median excision in front, into which the labium fits closely. The labrum and epistoma, with the labium and mentum, enclose the remaining mouth-parts completely, and often conceal them. Antennæ short, subulate, 6-jointed; the joints in order of diminishing length rank 3, 4, 5, 6 subequal to 2, and 1; joint 1 is the stoutest, and joint 3 is nearly as long as all the others put together. Mandible tapering from a broad oblique subtriquetrous base to a pungent tridentate crown; fangs conical, the intermediate very little smaller than the others, just below the bases of which the edges of the crown are minutely denticulated; endopodite strong and relatively long, subcylindrical, bidentate at its extremity, with a row of denticulations on each side just below the fangs; its base is immediately preceded by a tuft of velutinous or puberulose setæ [their puberulence is not distinguishable in a figure drawn to a scale of enlargement as low as 90], about 5 in number, and rather longer than the endopodite; molar region absent. The mandibles, as well as the 1st maxillæ, are virtually symmetrical; the latter terminate each in 4 strong, flattened, acuminate, chitinous teeth, the innermost of which are the strongest, and have 2 or 3 microscopically puberulose setæ close to their inner base; a short, solitary, smooth setula arises from the inner face of the lacinia near the transverse suture; the palpus, geniculated at the first joining, has the proximal joint strongly reflexed; its joints in sequence of lessening length rank 3, 1, 2, 4; the first two are stout, the others slender. Labium truncate-obtriangular, slightly rounded off at the corners, and bevelled at the sides to fit into the gap in the mentum; tongue and laciniæ of 2nd maxillæ absent; palpi geniculated, tapering distally, the proximal joints divaricate, and each nearly as long as the next joint. The joinings of the anterior ventral segments are sometimes dimly discernible through the plastron. Dr. Vayssière describes and figures (1882, figs. 106 & 108) 5 pairs of obtected tracheal branchiæ; his figures should be consulted. Caudal setæ plumose, indistinctly articulated, and about $\frac{2}{7}$ as long as the body. Legs slender; the fore tibia, in about $\frac{1}{2}$ its length from the tip, is armed interiorly with a row of articulated spines, denticulated on their inner sides. Hind leg rather the longest; the tarsus (claw excluded) less than $\frac{1}{2}$ as long as the tibia; this last about $\frac{3}{4}$ as long as the femur.

Type. *P. variegatum*, Lat.

Distribution. Rivers of continental Europe, and Madagascar.

Etymology. προσώπιον and στόμα, from the mouth-parts being well concealed by the large mentum &c. as with a little mask.

Prosopistoma foliaceum, Fourcroy. Pls. XV. 27 [wings, after Vayssière] & XLIII. [nymph].

Le Binocle à queue en plumet [Hist. abrég. des Ins. de Paris, ii. 660, pl. xxi. 3 e. f. g. (1764)]; Geoff., *op. cit.* ed ii. *loc. cit.* (1785) & ed. iii. (1799).

Binoculus foliaceus, Fourcroy, Ent. Paris, ii. 539 (1785).—*B. pennigerus*, Lat. Hist. Nat. Crust. & Ins. iv. 122 (1802).—*B. pisciforme*, Duméril, in Dict. Sc. Nat. iv. 106, Paris, Lenormant, art. *Binocle* (1816).

Limulus pennigerus, Müll., Entom. p. 127, no. 62 (1800?) [cited by Lat. 1802].

Prosopistoma punctifrons, Lat., Nouv. Ann. du Mus. (3), ii. 33 (1833); *id.*, *op. cit.*, iii. 40 (1843); Lucas, Dict. Univ. Hist. Nat. d'Orbigny, ed. ii., art. *Prosopistoma* (1869); Joly, Rev. d. Soc. Savants (2), v. 4–6 (1870)?; *id.*, Mém. Soc. Nation. Sc. Nat. Cherbourg, xvi. 329–336 (1871); Mül., Ent. Mo. Mag. viii. 227 (Feb. 1872); *id.*, Zoologist, 2955 (1 Feb. 1872); *id.*, Proc. Ent. Soc. London, 1st Jan. 1872, p. xlvi. (19 Feb. 1872); Westw., Athenæum (Feb. 24th, 1872); N. Joly, Mém. de l'Acad. des Sc. Inscript. et Belles-let. de Toulouse (7), vol. iv. Bulletin, pp. 437–438 (1872); *id.*, *op. cit.* pp. 440–441 (Mars, 1872); *id.*, in Le Progrès Lib. de Toulouse (19 Mars, 1872); Westw. & McLach., Ent. Mo. Mag. viii. 279 (1 April, 1872); *iidem*, Proc. Ent. Soc. London, 19 Feb., p. vi. (April 1872); E. & N. Joly, Ann. d. Sc. Nat. (5), Zool. xvi. Art. no. 7, pp. 16, pl. xiii. 1–16 (Sept. 1872); McLach., Ent. Mo. Mag. x. 109 (Oct. 1873); *id.*, Rep. Brit. An. for 1873, p. 118 (1874); *id.*, Journ. Linn. Soc., Zool. xii. 145 (1874); Joly ('Separate' of), Rev. des Soc. Sav. (2), iii. 69–72, p. 7, Note E (Digne Dec. 1874); N. &. E. Joly, in Le Prog. Lib. de Toulouse (17 Mars, 1875); *iidem*, Mém. de l'Acad. des Sc. Inscript. & Belles-let. de Toulouse (7), vii. 606–607 (1875); Joly, Feuil. d. Jeun. Nat. v. 68 (1875); *id.*, *op. cit.* vi. 53–54, pl. ii. 1–5 (Mars 1876); *id.*, Bull. Soc. d'Etudes &c. d'Angers, 1874–5, pp. 44–45, Notes E & G (1876); N. & E. Joly, Rev. des Sc. Nat., Montpellier, v. 307 &c., pl. viii. 32 [tracheal branchiæ] (Dec. 1876); Westw. Trans. Ent. Soc. London (1877), 189–194, pls. iv. B 1–5 & v. 1–12 [after Joly]; Joly, Ann. Soc. Ent. Fr. (5), viii., Bull., pp. 70–71 (Avril 1878); *id.*, Feuil. d. Jeun. Nat. no. 92, pp. 99–100 (Juin 1878); Joly & Vays., Compt. Rend. des Séanc. de l'Acad. des Sc. Paris, lxxxvii. 263–5 (Août 1878); Joly, Pet. Nouv. Ent. ii. no. ccv. 265 (Oct. 1878); *id.*, Feuil. d. Jeun. Nat. no. 98, pp. 24–25 (Dec. 1878); Joly & Vays., Bull. Soc. d'Etud. Sc. Nat. Nimes, no. vi.–vii. (1878); Joly, *op. cit.* (1879), pp. 3–7; *id.*, Proc. Ent. Soc. Fr. (1880), Bull. no. xi. 109; *id.*, Bull. Soc. d'Etud. Sc. d'Angers, 1878–9, pp. 157 note 2, 158 note 1, 164 notes, 167 Note B (1880); Vays. Ann. des Sc. Nat. (6), Zool., xi. 1–15, pl. i. 3–17 (1881) [nymph, subim., & details]; *id.*, *op. cit.* xiii. 77, pls. vi. 57, x. 105–109, xi. 104 & 110–114 [nymph and details] & 116 [diseased nymph] (1882).—*P. foliaceum*, Lucas, Ann. Soc. Ent. Fr. (6), ii., Bull. Ent. xcv. (Sept. 1882).

Chelysentomon or *Ch. pennigerum*, N. & E. Joly, in Le Prog. Lib. de Toulouse (Fev. 1872); *iidem*, Mém. de l'Acad. des Sc. Inscript. & Belles-let. de Toulouse (7), iv., Bull., pp. 437–438 (Fev. 1872); N. Joly, in Le Prog. &c. (19 Mars, 1872); *id.*, Mém. de l'Acad. &c. (7), iv., Bull., 440–441 (1872); N. & E. Joly, Mém. de l'Acad. &c. (7), iv., pl. figs. A-G & R (1872); *id.* Compt. Rend. Paris, lxxiv. 1413 (1872).

♀ *Subimago* (*in alcohol*).—Wings dark iron-grey, especially the anterior. Body reddish brown, darker above than beneath, and pale at the insertions of the legs. Length of body 3·78, wing 4·85, setæ 0·42 millim. (Vayssière).

Hab. France; the Garonne near Toulouse, chiefly to the right of île des Grands-Ramiers, not far from the powder-mills below the Pont d'Empalot (Joly); the Rhone at Avignon (Vayssière); the Seine above Paris (Geoff.), in the neighbourhood of Epône, Mantes, Bas-Meudon, and Point-du-Jour (Lucas). Germany: the Rhine at St. Goar, between Coblentz and Mayence (Dr. Noll, *teste* Prof. Leydig). Bohemia, in the Moldau, a tributary of the Elbe (Purkinje, *teste* Blanchard & Joly). The nymph inhabits swiftly flowing water from a few inches to 6 ft. deep, harbouring in irregularities of the under surface of rough stones, and shunning the light. It swims with agility, propelled solely by the caudal setæ, holding its legs closely folded up under the body. When desirous of repose, it is able to attach itself by adhesion, like a *Patella*, to a smooth surface; the joinings of the segments and of the head and thorax are then tightly contracted, to

prevent leakage, and the caudal setæ withdrawn more or less completely into the visceral cavity. The terminal segment also is partly retractile. What appear to be the perineal lobes form with the dorsum of that segment the extremity of the sheath of the setæ; and whilst these are passing into its aperture during retraction, the fringes of each seta collapse upon the rhachis successively. Dr. Vayssière conducted me to the river at Avignon, and captured a specimen without entering the water,—the only one that I have seen alive. He reared the *subimago* early in June at Avignon, and states that the fly is nocturnal.

About fifty literary references to *P. foliaceum* are cited above; of these only one relates to the subimago and egg, all the others to the nymph exclusively. The most important of them are Vayssière (1881 & 1882), Joly (1872, Sept.), and Westwood (1877, Oct.). This catalogue of *Prosopistoma* literature is very nearly exhaustive, and although many of the passages cited are tautological, yet the reiterated statements are not verbatim reprints of one another. Some of the 'Notes' designated by capital letters are special additions to the extracts reprinted as 'Separates.'

PROSOPISTOMA VARIEGATUM.

Prosopistoma variegatum, Lat., Nouv. Ann. du Mus. d'Hist. Nat. (3), ii. 23 (1833); Guérin-Mén., Ic. Règ. An. iii. 40, pl. xxxv. 4 (1829–44); Westw., Proc. Ent. Soc. Lond. (1872), p. vi.; *idem*, Trans. Ent. Soc. Lond. (1877), pp. 189–194, pl. iv. B 1–4.

Hab. Madagascar. Length of body of nymph 6 millim. (Latr.). An undescribed species.

In accordance with my usual custom, I refrain from passing criticisms upon the work of previous authors, preferring that it should be understood that where our conclusions may happen to differ upon any point concerning *Prosopistoma*, my not concurring with their opinions respecting it is not due to oversight of their observations.

Part III. Read February 19th, 1885.

Fourth Series of Group II. of the Genera of the Ephemeridæ.

Adult.—The anal (8) and second axillar (9^2) nervures, together with the inner margin of the mesothoracic wing, enclose a curved, trilateral, somewhat leg-of-mutton shaped space, which is abrupt at its anterior extremity; anal nervure distinctly separate from the pobrachial (7) at the base of the wing; first axillar (9^1) more or less curved, and rather long; second axillar approximated to or united with the first at the base, where this is distinctly independent of the anal nervure; præbrachial nervure (6) essentially simple. Hind wings small or absent; costal border spurred or protuberant at about the first $\frac{1}{3}$ of the wing's length; neuration incomplete, the subcosta somewhat curved. Thoracic spiracles straight-lipped, usually closed in the dried insect; mesothoracic spiracle without a guard, its valves unequal; when open, the apertures of both spiracles are oval. Pronotum of ♀ closely appressed to the mesonotum. Hinder tarsi absolutely 4-jointed, with the proximal joint long. Forceps-limbs sessile upon the segment, with a short fleshy protuberance from it between their proximal joints, which is not represented in the ♀. Penis normally retracted and invisible, very rarely protruded by captured living specimens. Median caudal seta aborted. Oculi of ♂ divided into two unequal parts; the upper segment, cylindrical or somewhat turbinate, is facetted solely on the terminal surface; the lower and much smaller segment, oval in form, is annexed to the under (or rarely to the anterior) orbit of the former, and is facetted all over with facets of less diameter than those of the turbinate part. Hinder ocelli large; the foremost much smaller. The virgin *imago* can live many days if kept in a moderately damp cool place. *Subimago* usually quiescent for at least twenty-four hours, standing upon all its feet with wings erect and setæ divergent.

Section 9 *of the Genera.*—Type of *Baëtis*. *Adult.*—Pronotum of ♀ transverse and short, prominent above and somewhat smooth, closely appressed to the mesonotum and receding in the middle behind. Hind tibia at least $\frac{3}{4}$ as long, and sometimes nearly of the same length as the femur; the tarsus from about $\frac{1}{2}$ to about $\frac{3}{4}$ as long as the tibia. Ungues in every tarsus dissimilar each to the other. Mesothoracic wings large, ovate-oblong, gradually rounded off from the terminal to the inner margin; the first and second axillary nervures (9^1 and 9^2) enclose a narrow space, which usually maintains an almost even width for some distance from the inner margin and (leaving cross veinlets out of account) commonly extends to the wing-roots. [In fig. 31 *d*, through individual aberration, the functions of 9^1 have evidently been usurped by an intercalar nervure, to which the numeral has therefore been assigned, whilst the true first axillary nervure is abbreviated and isolated.] Præbrachial nervure of the fore wing separate from the second of the following intercalar nervures, and therefore simple. *Nymph.*—Terminal margins of the mesothoracic wings free. Palpus of maxilla I. 3-jointed [probably 2-jointed in *Callibætis*], not shorter than the lacinia; the latter terminated at the tip with either spines or strong teeth, and near the tip nude externally, but armed with rigid setulæ, diversely in different genera, along the adjoining portion of the inner

edge. Tracheal branchiæ borne by segments 1–7 of the abdomen, all exposed, foliaceous, fringeless, and without fasciculated fibrils; those of segment 1 smaller than the intermediate pairs, sometimes minute and erect. Hinder angles of the abdominal pleuræ hardly produced at all. Setæ natatorial; the outer setæ ciliate along their inner side, and the median seta plumose, either throughout or in the greater part of their length. Natation agile, effected solely by undulations of the body and setæ, the legs trailing through the water extended at full length close to the sides.

The genera of this type have near relations with the *Leptophlebia* section of the second group of the Ephemeridæ. A common, though not universal, feature in the neuration of the fore wing in this group is noticeable in the order of shortening of the sectorial intercalary nervures, which are usually five in number. Their ordinary rank in diminishing length, when numbered successively from the foremost, is 5, 1, 4, 2, 3; or occasionally 5, 1 subequal to 4, 2, 3. In the third group of the genera, and also in some genera of the first group, their most frequent gradation is 5, 1, 1, 2, 3. Differences in the tarsi, and in the oculi of the males, disguise their affinities with the section of *Siphlurus* when adult; but their essential approximation to that type is manifest in the nymphs. The number of joints in the antennæ of nymphs of the *Baëtis* type largely exceeds the maximum hitherto observed in those of that section.

Compsoneuria, a genus of the *Ecdyurus* section of the third group of the Ephemeridæ, has the cross veinlets of the fore wings arranged very much in the same manner as in those of most of the genera of the *Baëtis* type. But, without looking at its hind wings and tarsi, and apart from other important differences, the forked præbrachial nervure (6) in the fore wing is sufficient to distinguish it from every genus of this type.

Summary of Generical Characteristics.—Type of *Baëtis*.

Among miscellaneous representatives of the genera, adult and in good condition, *Cloëon* is easily distinguished by the absence of hind wings; *Callibætis* by the large rounded costal projection and numerous cross veinlets of its broad, oblong, obtuse hind wings; *Baëtis* by hind wings as broad and obtuse as those of the preceding genus, but with the costal projection (if any) small and acute, and with scarcely a cross veinlet at all; *Centroptilum* by the extreme narrowness of its very small hind wings, and usually by the slenderness of their costal projection.

But to discriminate from *Cloëon* defective specimens of the other genera deprived accidentally of their hind wings is a task attended often with insurmountable difficulty. Satisfactory determinations of the genera of such examples may, however, be arrived at sometimes by means of the following indications afforded by the fore wings; or, when absolute determinations are impossible, a near approach may be made to their identification sufficient to facilitate the comparison of the defective specimens with better examples of the same insects. In the first place, it may be noted that in genera of the present type the rudimentary intercalar veinlets of the terminal margin of the mesothoracic wing are disposed either singly or in pairs. In a large majority of the species of *Cloëon* and *Centroptilum*, as well as in many of *Callibætis*, these veinlets are single. As a rule, the species of this last genus have more numerous cross veinlets than the others

in their fore wings, and this is especially noticeable in advance of the cubitus (4) in the proximal half of the wing. *Cloëon* and *Centroptilum* cannot be distinguished from one another absolutely by their mesothoracic wings; but several species of the former genus can always be recognized by peculiarities of minor detail not essential characteristics of that genus. The aforesaid intercalar veinlets are paired in *Baëtis*, in a few exotic species of *Centroptilum* and *Cloëon*, and often in *Callibætis*; their relative length is usually greatest in *Baëtis* and *Centroptilum*, which, like *Cloëon*, have fewer cross veinlets than *Callibætis* in advance of the cubitus in the proximal half of the wing. In *Baëtis* a short veinlet from the inner margin of the fore wing almost invariably meets the second axillar nervure (9^2) so as to form a small fork; but the corresponding nervure is simple in *Centroptilum*.

In the Appendix will be found a statement of the classification of these genera, adopted by me in 1868, which was accidentally omitted from page 20.

The nymphs may be tabulated as follows:—

Tabulation of Nymphs of Section 9 of the Genera.—Type of Baëtis.

Abdominal tracheal branchiæ all simple; the laminæ
- broadly obovate, obtuse. Terminal joint of the palpus of maxilla II. rotund, forming with the penultimate a clavate mass indented on the inner side at the joining. Terminal joint of the palpus of maxilla I. long ..... Pl. XLIV. *Baëtis*.
- partly oblong and partly ovate-lanceolate, oblique and acute. Terminal joint of the palpus of maxilla II. short and ellipsoidly rounded at the tip, forming with the penultimate joint a simply clavate mass. Terminal joint of the palpus of maxilla I. very short..... Pl. XLV. *Nameless Gen.*
- partly linear-obovate-lanceolate, and partly broadly so, acute. Terminal joint of the palpus of maxilla II. quadrangular, forming with the penultimate joint a compressed clavate mass broadly and abruptly truncate at the end. Terminal joint of the palpus of maxilla I. long and slender..... Pl. XLVI. *Centroptilum*.

Abdominal tracheal branchiæ mostly, or all, conduplicate with unequal segments; the larger segments of the laminæ
- irregularly subrotund; the laminæ of the hindermost branchiæ single. Terminal joint of the palpus of maxilla II. large and compressed, forming with the penultimate joint a compressed clavate mass obliquely truncate and acute at the extremity. Palpus of maxilla I. triarticulate, with the terminal joint long and slender ..... Pl. XLVII. *Cloëon*.
- of the first and second of the series somewhat contorted; those of the 3rd to 6th obliquely subovate; that of the seventh elongate-oval; all of the laminæ are duplicate, but the lesser lobes are much smaller in most of the series than those of *Cloëon*. Terminal joint of the palpus of maxilla II. small, forming with the penultimate joint a narrow slightly compressed mass, acute at the point. Palpus of maxilla I. (in alcoholic specimens) 2-jointed, with the last joint long; but if ever triarticulate, the terminal joint would be minute [the joining might have been obliterated in the samples examined]..... Pl. XLVIII. *Callibætis*.

BAËTIS, Leach, 1815.

Illustrations.—Adult (details), Pls. XVI. & XVII. 29 *a–f*, also LXIV. 9–20; (whole figures) see citations, under *Baëtis*, of *Cloë* Pictet *passim*. *Nymph*, Pl. XLIV.; see also Pictet, *op. cit.* pls. 34 & 36 (1843–5).

Adult.—Hind wing oblique, widened rapidly in front from the roots to the costal projection, usually rather broad and obtusely ovate, but sometimes oblong or ovate-lanceolate with the tip ellipsoidally rounded; costal projection in general small and acute, but in *B. atrebatinus* suppressed; neuration very sparse, comprising only 2 or 3 distinct longitudinal nervures (of which the intermediate is forked in some instances), the great cross vein, and in certain species very scanty feeble traces of rudimentary cross veinlets or intercalar veinlets that are liable to much individual variation. Fore wing [except *B. Salvini*, Pl. XVI. 29 *a*] devoid of colour ornamentation; marginal and submarginal areas [with the same exception] free from cross veinlets from the great cross vein to the bullæ; terminal margin beset with paired rudimentary intercalar veinlets; cross veinlets in the disk disposed mainly in two dislocated series between the subcosta and the cubitus (5), and two, also dislocated, behind the latter nervure, with occasional sparse indications, near the base and tip of the wing, of others irregular and defective, all at some distance from the terminal margin. Of the series in advance of the cubitus, the innermost commences at the subcosta or radius shortly beyond the bullæ and extends quite to the cubitus, if not farther, often blending with the outermost of the posterior series; the second series in advance of the cubitus starts abreast of the former just before the pterostigmatic dilatation of the marginal area, and terminates at the hindermost of the sectorial intercalars; the defective third anterior series nearer the apex of the wing is usually represented by only a single cross veinlet uniting the shortest of the sectorial intercalars with the one immediately in front of it. Of the two main series of cross veinlets posterior to the cubitus the outermost is the longest, extending most commonly from this nervure to the first axillar, but sometimes to the second axillar; between the cubitus and the pobrachial (7) nervure the cross veinlets composing it are liable to displacement outwards so as to be nearly in even line with the innermost of the anterior series, above described, rather than with the remainder of their own series: the second of the series posterior to the cubitus is liable to a similar dislocation outwards between the same two nervures, and to displacement inwards posterior to the anal (8) nervure; its first portion reaches from the pobrachial to the cubitus [in *B. Salvini* it is prolonged to at least the sector (4)] somewhere near the proximal extremity of the fifth sectorial intercalar; its intermediate portion is a single cross veinlet between the pobrachial and anal nervures, in a line with the junction of the sector and cubitus; its third portion lies nearer the wing-roots between the anal and second axillar nervures; sometimes a third posterior series is indicated by a few cross veinlets quite close to the axilla, which commences at the anal nervure. Forceps-limbs of ♂ 4-jointed; basal joint short and compact, considerably the stoutest, and suddenly contracted towards the distal joining; second joint rather stout and usually tapering gradually from the base; third joint comparatively slender, subcylindrical,

often somewhat curved, and usually much the longest; fourth joint commonly subglobular or oval and much the shortest, seldom elongate-oval and as long as the third. The interspace between the basal joints of the forceps-limbs varies in relative width with the species. Lobes of the penis without apparent stimuli. The intermediate segments of the ♀ abdomen are mutually subequal in length. Caudal setæ in ♂ im. 2–2½, in ♀ im. 1¼–2½, in ♂ subim. 1⅙–1⅐, in ♀ subim. ⅞–1⅐ as long as the body. Fore tarsus of ♂ very nearly of equal length with the tibia, which is about 1⅓ as long as the femur; its joints in diminishing succession rank 2, 3, 4, 5, 1: fore tarsus of ♀ about ⅔ as long as the tibia, which is just as long as the femur; its joints rank 2, 5, 3, 1, 4. Hind tarsi of ♂ about ⅔ as long as the tibia; the joints, shorter than in the ♀, rank 1, 4, 2, 3. *Nymph.*—Abdominal tracheal branchiæ all somewhat alike in form, each obtusely ovate or obovate and traversed lengthwise by a pinnately branched, irregularly subdivided trachea. Antennæ about as long as the head and thorax together. Outer caudal setæ about ¾ as long as the body; median seta commonly ⅔ as long as it, but in some species (e. g. *B. melanonyx*) of shorter proportions; the fringes narrowed acuminately to the extremities of the setæ. Each mandible terminates in a slightly prolonged, compressed, and obliquely abrupt lobe, croso-denticulate at its termination; endopodite absent. Palpus of maxilla I. as long as the lacinia, 3-jointed; the terminal joint slender and about as long as the other two together: the lacinia armed with compressed teeth at the point, that are preceded by a series of setulæ on the inner edge, arranged evenly and gradually increasing in length away from the teeth, so as to constitute an acute oblique-pointed flattened beard. Laciniæ of maxillæ II. narrow and cultriform, broader than the subulate lobes of the labium; proximal joint of the palpus about as long as the remainder, which are compressed and combined into a clavate piece rounded at the tip and slightly indented on the inner side just before the tip, the terminal joint being subrotund and somewhat imperfectly delimited by suture from the penultimate joint. Tongue, as a whole, cuneate, with the narrower extremity truncate; the median lobe narrower than the paraglossæ and bluntly mucronate. Hind tarsus, claw excluded, about ⅔ as long as the tibia; the leg altogether about as long as the fore leg. Resident in running water and lakes; two brooded in temperate regions.

Type. B. binoculatus (in *Ephemera*), Linn.

Distribution. Europe, including Egypt and Greenland; Northern and Central America, the Argentine Republic, and perhaps Chili; Asia; Indo-Malay region and Australia.

Etymology doubtful; probably a misreading of Bætis, the classical name of the Guadalquivir.

Synonymous with *Brachyphlebia*, Westwood (1840). At p. 20 *ante* reference is made to the identity with *Baëtis* of the nymphs partly figured in detail by M. Vayssière (1882) under the name ‡ *Centroptilum*; and also to the probability of those quoted by him as ‡ *Cloëon* being only junior grades of the same. The difference in form of the laminæ of their tracheal branchiæ, judging from the description, is such as might readily be produced by the alcoholic solution in which the specimens were preserved. Distention of these laminæ by endosmosis, to a large or small extent, is an accident of common

occurrence; and M. Vayssière is not the first nor the second entomologist who has been misled by it.

The nymph of *Baëtis* has probably been reared by others besides myself. I have identified and examined those of *B. vernus*, *B. rhodani*, *B. gemellus*, *B. melanonyx*, and *B. pumilus*, in addition to many undetermined species.

The species of this genus being numerous are arranged geographically in the following order:—European, North American, Central American, South American, and Cingalese. The figures of wings and forceps of European species published in 1871 were engraved after a photograph on reduced scale of my original drawings; but the engraving was not faithfully executed in *fac-simile*, and consequently the value of the figures was impaired. I therefore deem it advisable to reissue some of them, on the scale of the original drawings.

EUROPEAN SPECIES.

BAËTIS BINOCULATUS, Linn. Plate XVI. 29 *b* (wings and forceps).

[*Ephemera*] or *E. bioculata*, Linn., [Act. Upsal. (1736) 27, no. 2; *id.*, Fn. Suec. ed. i. no. 751 (1746)]; *id.*, Syst. Nat. ed. x. i. 547 (1758); *id.*, Fn. Suec. ed. ii. no. 1473 (1761); [Geof., Hist. Abr. d. Ins. . . . . Paris, ii. 239, no. 5, pl. xiii. 4 (1764)]; Mül., Fn. Ins. Fried. no. 556 (1764); Linn., Syst. Nat. ed. xii. pars ii. 906 (1767); Fab., Syst. Ent. 304 (1775); *id.*, Sp. Ins. i. 384 (1782); Ström. N. Saml. Kongl. Dansk. Vidensk. Selsk. Skrift. ii. 91 (1783); Fab., Mant. Ins. i. 244 (1787); Vill., C. Linn. Ent. iii. 18 (1789); [Zsch., Mus. Lesk. i. 150, no. 16 (1789)]; Gmél., Linn. Syst. Nat. ed. xiii. i. pars v. 2629 (1790); Ol., Encyc. Méth. vi. 419 (1791); Fab., Ent. Syst. emend. iii. pars i. 70 (1793); Schr., Fn. Boica, ii. pars ii. 199 (1798); Cederh., Fn. Ingricæ Prodr. 134 (1798); Walck., Fn. Paris. ii. 9 (1802); Lat., Hist. Nat. Crust. & Ins. xiii. 97 (1805); Shaw, Gen. Zool. vii. part ii. pl. lxxxi. (1806); Lamarck, Hist. Nat. d. Anim. s. Vertèbr. ed. i. iv. 221 (1817); Stewart, Elem. Nat. Hist. of Anim. Kingd. ed. ii. ii. 225 (1817); Guér., Iconograph. Règn. Anim. ii. pars i. pl. lx. 9 (1829–43); Gray, Griffith's Anim. Kingd. ii. pl. xciv. 9 [after Guérin] (1832); Zet., Ins. Lapp. col. 1046 (1840); Westw., Introd. . . . . Classif. of Ins. ii. 25 (1840); Blanch., Hist. Nat. d. Ins. iii. 54 (1840); Wallengren, Christ. Vidensk. Forhandl. no. ii. 21 (1880).—*E. fuscata*, Linn., Fn. Suec. ed. ii. no. 1474 (1761); Mül., Fn. Ins. Fried. 63 (1764); Linn., Syst. Nat. ed. xii. pars ii. 907 (1767); Vill., C. Linn. Ent. iii. 19 (1789); Gmél., Linn. Syst. Nat. ed. xiii. i. pars v. 2629 (1790); Ol., Encyc. Méth. vi. 419 (1791); Fab., Ent. Syst. emend. iii. pars i. 70 (1793); Walck., Fn. Paris. ii. 9 (1802); Lat., Hist. Nat. Crust. & Ins. xiii. 97 (1805).—*E. diaphana*, Mül., Zool. Dan. Prodr. 143 (1776).—*E. flava*, Schr., Beytr. z. Naturgesch. 82 (1776); *id.*, En. Ins. Austr. indig. no. 605 (1781); Vill., C. Linn. Ent. iii. 22 (1789); Ol., Encyc. Méth. vi. 421 (1791); Schr., Fn. Boica, ii. pars ii. 199 (1798).—*E.* ‡ *lutea*, Fourc., Ent. Par. ii. 352 (1785).—*E. notata*, Gmél., Linn. Syst. Nat. ed. xiii. i. pars v. 2630 (1790); Ol., Encyc. Méth. vi. 422 (1791).—*E.* ‡ *culiciformis*, *id.*, *op. cit.* vi. 420, note [excl. descript.] (1791); Lat., Hist. Nat. d. Crust. & Ins. xiii. 98? (1805).—*E.* ‡ *striata*, Walck., Fn. Paris. ii. 10? (1802).

Baëtis bioculatus, Leach, Brewst. Edinb. Encycl. ix. 137 (1815); Sam., Ent. Comp. 259 [*B. bioculata*] (1819); *id.*, Ent. Cab. ii. no. 53, pl. xxiv. 1 (1834); Steph., Ill. Brit. Ent. vi. 65 (1835); ! Etn., Ent. Mo. Mag. v. 88 (1868).—*B. binoculatus*, ! Etn., Trans. Ent. Soc. Lond. (1871) 111, pls. ii. 9 & v. 16, 16*a* [details]; Hag. & Etn., *op. cit.* (1873) 401; Meyer-Dür, Bull. Soc. Ent. Suisse, iv. 309 (1874); Palmén, z. Morphol. d. Tracheensyst., Sect. i. pl. i. 1–7 (1877); Rostock, Jahresb. d. Ver. f. Naturk. Zwickau, 1877, p. 86 (1878); ! Etn., Ent. Mo. Mag. xvii. 196 (1881); Palmén, Paar. Ausf. gange d. Geschl. org. b. Insect. S. 71 [anatom.] (1884).—*B. flavescens*, Curt., Lond. & Edinb. Phil. Mag. ser. 3 (1834) 121;

Pict., Hist. Nat. Névropt. ii. Ephém. 193 (1843–5); Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 561 (1853).—*B. autumnalis,* Curt., Lond. & Edinb. Phil. Mag. ser. 3 (1834) p. 121; Steph., Ill. Brit. Ent. vi. 67 (1835).—*B. fuscata,* Steph., *op. cit.* vi. 66 (1835).

Brachyphlebia bioculata, ! Westw., Introd. to Mod. Classif. of Ins. ii. 25 & Addend. to Gen. Synops. 158 (1840).

Cloë bioculata, Pict., Hist. Nat. Névropt. ii. Ephém. 241, pls. xxxiv.–xxxv. (1843–5); Hag., Smithson. Miscell. Coll. (1861) Synop. Neuropt. N. Am. 52 [excl. example in Brit. Mus.]; *id.,* Stet. Ent. Zeit. xxvi. 229 (1865); Oulianine, Neuropt. & Orthopt. of the Prov. of Moscow, p. 28 (1867).—*C. autumnalis,* Pict., Hist. Nat. Névropt. ii. Ephém. 270 (1843–5).—*C.* ‡ *pumila,* Oulianine, Neuropt. & Orthopt. of the Prov. of Moscow, p. 28 (1867).

Cloëon bioculata, Walk., List of Neuropt. Ins. in Brit. Mus. 572, exempl. 1 *a–f* [excl. g.] (1853).—*C. autumnalis,* Walk., *op. cit.* 578 (1853).—*C.* ‡ *pumilum,* ! Hag., Ent. Ann.(1863) 33; ! Etn., Ann. & Mag. of Nat. Hist. (3) xviii. 147 (1866).

Subimago (*living*).—Wings pale grey or smoke-grey; the hind wings sometimes paler or whitish ochraceous. Femora greenish grey or very pale greenish yellow or greenish white, with pale grey tibiæ and black tarsi, the green tint more pronounced in the female sometimes, and then her fore femora are pale olive-green with a dark spot before their distal extremities, while her hinder tibiæ acquire a greenish yellow tint. Setæ pale grey.

Imago (*living*).—♂. Turbinate eyes lemon- or bright yellow; lower eyes yellowish green, black-green, or piceous.

♂ *var.* 1. Thorax burnt sienna, or fuscous, or pitch-black above. Abdomen in segments 2–6 or 7 translucent white, with a more or less slight pale yellow tint, and with the spiracles and sometimes the tracheal trunks rubiginose or black; the remaining segments above either burnt sienna, or fuscous, or fusco-olivaceous, edged distally with bright yellow; the last segment sometimes lighter above than the others, and beneath either ochraceous or olivaceous. Setæ and forceps white. Femora yellowish white, the rest of the fore legs white or greyish white; the rest of the hinder legs white. Wings vitreous, with whitish neuration, but with the base of the subcosta and radius sometimes fuscous.

♂ *and* ♀ *var.* 2. Body either light bistre-brown or greenish bistre-brown or olivaceous above, with the extreme tips of the abdominal segments either narrowly darker or bright yellow, and the subcutaneous tracheæ black or intense sepia-brown; venter olivaceous, marked with two dark dots near the base of every segment. Setæ either greenish white or else white or greyish, and tinged at the bases with greyish or dusky. Eyes of ♀ either olivaceous, piceous, or black. Legs in some lights olivaceous; in others the fore femur becomes fusco-olivaceous, with the knee pale, and the tibia and tarsus either uniformly warm sepia-brown, or the tibia brownish black and the tarsus charcoal-black; hinder femora and tibiæ much paler than the anterior, and marked before the knee with a curved greyish spot; hinder tarsi grey. Length of body 4–8; wing 6–8; setæ ♂ im. 12–14, subim. 7–10, ♀ im. 10–12, subim. 8–10 mm.

Hab. Europe, from Portugal, near Cintra (380 ft., 27 April, 1880), eastwards to Southern Persia and Armenia (Hagen Mus.), northwards to Moscow and Scandinavia. North America, in Hudson's Bay Ter. (Dale Mus.). The species is common in rivers northwards

of the Pyrenees and Alps. Amongst localities in France where it has been captured may be mentioned Orthéz, Blois, and the Vosges.

Baëtis venustulus, sp. nov. Plate LXIV. 10 (forceps).

Imago (*living*).— ♂. Turbinate eyes citron-yellow; lower eyes olivaceous. Notum greenish bistre-brown (virescenti-fuscum) varied posteriorly with bistre-brown; the parts adjoining the meso- and meta-sterna are of the former colour, or olivaceo-fuscous. Segments 2–6 of the abdomen translucid white, with a cretaceous tint on the dorsum, and black spiracles; segments 7–9 above fusco-olivaceous with ochreous joinings and dark stigmata, beneath more or less ochraceous; segment 10 somewhat of a purplish tint above. Forceps and setæ smoky white. Femora translucid white, tinted very faintly at the tips with cretaceous; tibiæ and tarsi smoky white, with the ungues and in the hinder tarsi the terminal joints darker. Wings and neuration colourless; pterostigmatic cross veinlets variable.

♀. Very like *B. binoculatus* ♀. Oculi and orbits of ocelli olive-green; a rufescent spot on each side between the base of the antenna and the oculi. Hinder femora spotless; tibiæ and tarsi all dark smoky grey, with the tarsal joinings and the tips of the terminal joints darker. Neuration of wings pitch-black. Abdominal spiracles (not the tracheæ) black. Length of body 4–4·5; wing ♂ 4·5, ♀ 5; setæ ♂ im. about 9, ♀ im. 6·5 mm.

Hab. Switzerland; the Rhone, in the vicinage of Geneva, above the confluence with the Arvé; 25 August, 1879, on wing in the evening before dark.

Baëtis scambus, Etn. Plate LXIV. 9 (forceps).

Baëtis scambus, ! Etn., Trans. Ent. Soc. London (1870) 3; ! *id., op. cit.* (1871) 112, pl. v. 17, 17 *a* [details].

Subimago (*living*).—Wings, setæ, tibiæ, and tarsi cinereous; forceps-limbs and femora cretaceous, or sometimes the latter are greenish white and are marked in the ♀ almost imperceptibly with a cinereous spot before the knee.

Imago (*living*).— ♂. Turbinate eyes clove- or warm sepia-brown; lower eyes black. Notum jet- or pitch-black. Abdominal segments 2–6 translucent white or greenish white, faintly suffused with light bistre-brown; the others bistre-brown. Setæ white, with a few of the basal joinings darker. Wings vitreous. Femora either cretaceous or olive-grey; fore tarsus smoky grey; hinder tibiæ and tarsi greenish white, with ungues and the tarsal joinings slightly darkened.

♀. Body olivaceous-brown. Eyes intense olivaceous. Femora olivaceous; tibiæ and tarsi dark smoky grey. Wings vitreous, with pitch-black neuration. Setæ smoky grey, with subopaque joinings. Length of body 6–6·5; wing 6–7; setæ, ♂ im. 12, subim. 7, ♀ im. 9–10, subim. 5 mm.

Hab. England; Ashbourne and Norbury, Derbyshire, in the Dove and in the Henmoor Brook; June and September. Forceps rather similar to those of *B. binoculatus*; but the limbs are more slender, and are closer together at the base. Hind wings binerved.

Baëtis vernus, Curtis. Plate XVI. 29 *d* (forceps).

? *Ephemera* ‡ *bioculata*, Fourcroy, Ent. Paris. ii. 352 (1785).—? *E. testacea* [Zsch., Mus. Lesk. i. 50, no. 17 (1789)]; Gmél., Linn. Syst. Nat. ed. xiii. i. pars v. 2630 (1790); Ol., Encyc. Méth. vi. 422 (1791).—‡ *E. dubia*, ! Steph., Ill. Brit. Ent. vi. 59 (1835).

Baëtis vernus, Curt., Lond. & Edinb. Phil. Mag. ser. 3 (1834) 121; ! Steph., Ill. Brit. Ent. vi. 66 [*B. verna*] (1835).—*B.* ‡ *culiciformis*, ! Steph., *op. cit.* vi. 66 (1835).—*B. phæopa*, ! *idem, inter synon.* (1835).—*B.* ‡ *striata*, ! *id., op. cit.* vi. 65 (1835).—*B. phæops*, ! Etn., Trans. Ent. Soc. London (1870) 4; ! *id., op. cit.* (1871) 115, pl. v. 21, 21 *a* [details]; Meyer-Dür, Bull. Soc. Ent. Suisse, iv. 310 (1874).

Cloë verna, Pict., Hist. Nat. Névropt. ii. Ephém. 270 (1843–5).

Cloëon verna, Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 578 (1853).

Subimago (*living*).—Wings smoky or mousey grey; setæ and forceps smoky. Femora either testaceous grey, light greenish grey, or even greenish white, each with an ill-defined dark v-shaped mark before the extremity; tibiæ smoky, the anterior black at the tip; fore tarsus black; hinder tarsi cinereous, with black joinings.

Imago (*living*).—♂. Turbinate eyes burnt-umber; lower eyes brown-black. Notum at first bistre-brown, changing with maturity to pitch- and jet-black. Dorsum of abdomen variously coloured; either bistre-brown or darker, with the extreme edges of the joinings greyish white; or in segments 2–7 bistre- or greenish grey and translucent, and in segments 8–10 bistre-brown with dark tracheæ; venter cinereous. Setæ white or smoky-grey. Forceps-limbs greyish white, or more of a greyish tint towards the base, with the last two joints white. Wings vitreous, with suffuscous longitudinal neuration. Fore femur subolivaceous, with a dark rounded spot before the tip; the tibia whitish grey, the tarsus dark grey: hinder femora either greenish grey, or cretaceous with a light greenish tint; tibiæ whitish; tarsi whitish or greyish white, with the joinings and the uncinate claw scarcely darker.

♀. Very similar. Eyes sepia-black or black. Notum at first pitch-brown, becoming pitch-black or black. Femora olivaceous; tibiæ greyish- or greenish-white; tarsi charcoal-black with black joinings, the fore tarsus darker. Setæ white, tinged with brown-black basewards. Length of body 5·5–8; wing, ♂ 5–7, ♀ 7–9; setæ, ♂ im. 12–16, subim. 5, ♀ im. 10–12, subim. 7 mm.

Hab. Great Britain; Finmark, Hammerfest and Alten. It frequents English streams and rivulets in May, June, September, and October. The adult ♂ may be recognized by the forceps-limbs having each a callus at the interior extremity of the basal joint, no very marked denticulation at the inner base of the second joint, and an ovate-oblong terminal joint.

Baëtis rhodani, Pictet. Plates XVI. 29 *c* (hind-wing, ♂ head), and LXIV. 12 (forceps).

Cloë rhodani, ! Pict., Hist. Nat. Névropt. ii. Ephém. 218, pls. xxxvi.–xxxix. (1843–5); Brauer, Neuropt. Austr. 26 (1857); ! Hag., Ann. Soc. Ent. Fr. (4) iv. 39 (1864); Meyer-Dür, Mitth. Schw. Ent. Ges. i. 221 (1864); ? Oulianine, Neuropt. & Orthopt. of the Prov. of Moscow, p. 28 (1867); Ausser., Ann. d. Soc. Natur. Modena, Ann. iv. 136 (1869); Joly, Rev. d. Sc. Nat. Montpellier, v. 310, pl. vii. 17–18 (1876) [details].—*C. maderensis*, ! Hag., Ent. Mo. Mag. ii. 25 (1865).

Cloëon rhodani, Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 573 (1853); Hag., Ent. Ann (1863) 31; ! Etn., Ann. & Mag. of Nat. Hist. (3) xviii. 147 (1866).

Baëtis rhodani, ! Etn., Trans. Ent. Soc. London (1871) 114, pl. v. 20, 20 *a* [details]; Meyer-Dür, Bull. Soc. Ent. Suisse, iv. 309 (1874); Rostock, Jahresb. d. Ver. f. Naturk. Zwickau, 1877, p. 86 (1878); Palmén, Paar. Ausf. gänge d. Geschl. org. b. Insect. S. 64, 68, 71, taf. iii. 45 [anatom.] (1884).

Subimago (*living*).—Wings either cinereous or dark brownish grey, with greenish grey neuration. Fore femur greenish grey, with a dark crescentic spot or an ill-defined light grey spot before its distal extremity, the tibia light sepia-grey, the tarsus dull black; hinder femora light greenish- or yellowish-white, the tibiæ greyish white, the tarsi dull black; setæ greenish grey, with reddish or warm sepia-brown joinings.

Imago (*living*).— ♂. Turbinate eyes intermediate in colour between deep sepia- and madder-brown above, much lighter at the sides; lower eyes deep sepia-brown. Thorax jet-black above. Abdomen in large examples greyish bistre- or umber-brown in segments 2–6 or 7, with the joinings opaque; the remaining segments of a richer umber- or bistre-brown, with ochraceous joinings; venter dark greenish grey, often with two short divergent sepia-grey lines, each followed by a dot near the base of almost every segment. Setæ greenish grey, with sepia-brown or dull red joinings. Forceps greyish or greenish grey, their third and fourth joints whitish, more or less. Femora light olive-green or dark greenish grey; tibiæ and fore-tarsus light grey; hinder tarsi light grey or black. Wings vitreous, the nervures very faintly tinged with bistre-grey.

Variation.—Small examples have segments 2–7 of the abdomen translucent light greyish, each of these having the usual three dorsal linear marks in the middle of its base and the spiracles faintly darker grey, and having the edge of the distal border of the segment in the middle of the back, and also a spot in the midst of the dorsum on each side, orange-fuscous. Legs greyish, the tibiæ in some lights appearing whitish with their tips dark grey, and the hinder tarsi dark grey.

♀. Very similar to the male; the abdomen opaque throughout. In specimens of either sex that have only just cast the subimaginal slough, the thorax is usually pitch-brown above; it becomes jet-black afterwards. Length of body 5·5–9; wing 5·5–9 ♂ and –12 ♀; setæ, ♂ im. 13–19, subim. 10·5, ♀ im. 16 mm.

Hab. Great Britain, in streams and rivers, ascending to upwards of 1000 ft. in Derbyshire; in the south this species is matured on sunny days in the depth of winter where the water has an average temperature at that season of about 51° F. Widely distributed on the Continent: the Vosges (M°Lach.); lowlands of Switzerland, *e. g.* Lake of Geneva (1230 ft.), Tirol (Brauer); also Corsica (Bellier). Common in Madeira up to 3000 ft. and in Gran Canaria, near Sta. Brigida and San Mateo up to about 4600 ft. The terminal joint of each of the forceps-limbs is small and globular.

Baëtis Bocagii, sp. nov. Plate LXIV. 13 (forceps).

Subimago (*living*).—Wings tinted with griseous.

Imago (*living*).— ♂. Turbinate eyes dull light red; lower eyes dark olivaceous. Thorax jet-black above. Abdomen in segments 2–6 fusco-griseous, with the joinings of the segments and an abbreviated longitudinal line from the base on each side of the median

line of each of them darker; segments 7–10 fusco-lutescent; venter greenish grey, tinged with brown ochre in segments 8–10; the first two joints of the forceps lurid, varied with fusceseent, the other two fumatose. Setæ smoky white, with rusty-reddish joinings. Fore femur greenish grey, the tibia and tarsus sepia-grey or dusky; hinder femora paler, the tibiæ and tarsi whitish grey or smoky, with black joinings. Wings vitreous; subcosta and radius of the fore wing, and other longitudinal nervures towards the base of the wing, light amber-yellow, becoming blackish in the outer part of the disk; cross veinlets likewise blackish. Length of body, ♂ im. 10, wing 10, setæ 19 mm.

Hab. Portugal. The streamlet near Benfico, which passes under Alcantara, Lisbon; 23 May, 1880. The temperature of the water at the time was 66° F. Named out of compliment to the learned investigator of the Portuguese fauna, Senhor Barboza du Bocage.

Baëtis gemellus, sp. nov. Plate LXIV. 14 (forceps).

Baëtis ‡ *rhodani*, var., ! Etn., Trans. Ent. Soc. London (1871) p. 114.

Subimago (*living*).—Wings dark smoky grey in ♂, darker in ♀; setæ of a like colour, with rufescent joinings in ♂. Fore femur of ♂ dull yellowish tinged with grey, with a dark spot inside before the knee; tibia blackish grey or dusky; tarsus charcoal-black; hinder femora pale greenish smoky grey; the remainder of the hinder legs smoky grey, with the tarsal joinings black. Femora of ♀ light yellowish grey; tibiæ and tarsi smoky grey, with the tarsal joinings black.

Imago (*living*).— ♂. Turbinate eyes bright light red; lower eyes olivaceous or olivaceo-fuscous. Notum either light brownish ochre streaked with fuscous or pitch-brown, or else fuscous with the sutures raw-sienna yellow. Abdomen in segments 2–6 pellucid white, with the joinings and rounded lateral nebulæ above the pleuræ suffused with either yellowish fuscescent or raw sienna; the remainder of the dorsum either raw sienna throughout, or only so in segments 9 and 10, when segments 7 and 8 are light brown-ochreous fuscous; segment 10 bright yellow beneath. Setæ smoky or dusky, with medium burnt-sienna red or black joinings. Fore femur and base of the tibia in some lights tinted with light amber-yellow, changing in other lights to a stronger yellow; the remainder of the tibia and the tarsus dusky or dull greenish grey, with darker joinings. Hinder femora either dull whitish amber, or whitish tinged with olive-green; tibiæ and proximal joints of the tarsi either whitish or light yellowish smoky white; the remainder of the tarsus dusky, with darker or black joinings; ungues black. Forceps smoky white or greyish fuscous; the basal joints raw sienna. Wings vitreous; the stronger longitudinal nervures slightly amber-tinted, and towards the base of the wing of a greenish grey tint; the costal projection of the hind wing slightly fuscescent.

♀. Eyes pitch-black; the space between the ocelli, the basal joints of the antennæ, and a spot on each side intermediate between the eye and the insertion of the antenna, raw-sienna yellow; epistomum ochraceous, with fuscous carina. Abdomen fuscescent above, with the terminal margins of the intermediate segments rufo-piceous, edged very narrowly in segments 2–5 with yellow-ochre, and with the sides of the dorsum lighter near the pleuræ; venter lighter than the dorsum, with the joinings darkened; the last two segments tinged with raw-sienna yellow. Legs somewhat as in the ♂, but darker;

the fore tibia olivaceous. In drying, the legs acquire yellowish amber tints. (The alpine condition.)

Length of body, ♂ 6–8·5, ♀ 6–11; wing, 6·5–11; setæ, ♂ im. 13–25, subim. 8·5, ♀ im. 11, subim. 8 mm.

Hab. Spring-water streams in the mountains of Switzerland, N. Italy, Savoy, and Central Italy: July to September. Thusis and Val Anzasca (M'Lach.); near Champéry, Valais, in streamlets having at altitudes of 3700–4000 ft., between 2 and 4 P.M. in August, temperature ranging from 54° to 62° and 68° F.; also at a spring in the same neighbourhood at Les Clous (4000 ft., 6·50 A.M., 13 August, 1879, water 45° F. [large specimen]): also near Samoëns (2280 ft., 5·30 P.M., 13 Sept., water 54° F.); also in Val Montjoie between Contamines and Notre Dame de la Gorge. Common in the Apennino Pistojese near San Marcello, in streamlets tributary to the Limestre, both in the chestnut wood below Gavinana (2550–2750 ft.), and at a streamlet crossing the highway nearer San Marcello (2160 ft., 3·40 P.M., 27 July, '82, water 63° F.). The temperatures quoted give sufficient indications of the water-climate suitable to the species, and may be of use in the selection of sites for collecting. The Apennine specimens are just appreciably brighter in the colour of their bodies than Alpine examples; but the difference is very slight indeed.

BAËTIS ATREBATINUS, Etn. Plate LXIV. 15 (forceps).

Baëtis atrebatinus, ! Etn., Trans. Ent. Soc. London (1870) 4; *id., op. cit.* (1871) 113, pl. v. 19, 19 a [detail].

This species (*living subimago & imago*) closely resembles *B. rhodani*, but is distinguishable therefrom by the almost complete suppression of the usual projection in front of the hind wing near the base of the costa, and by an acute prominent black point in a shallow rounded depression in the protuberant part of the segment [probably the point of the penis] above the forceps in the middle line of the venter. Length of body 7–8; wing 6–8; setæ, ♂ im. 11–13, subim. 8·5, ♀ im. 8–10, subim. 7·5 mm.

Hab. England. The Kennet near Reading, Berkshire; captured when in subimago and at rest upon herbage fringing the towing-path of the canal between the mill and the county bridge nearest the junction of the Basingstoke and Devizes railways: October.

BAËTIS TENAX, Etn. Plate LXIV. 16 (forceps).

Baëtis tenax, ! Etn., Trans. Ent. Soc., London (1870) 5; ! *id., op. cit.* (1871) 116, pl. v. 22, 22 a [detail].

Imago (*living*).— ♂. Turbinate eyes intense warm sepia-, or chocolate-brown; lower eyes sooty-black. Notum jet-black. Abdomen in segments 2–6 translucent, tinted with olive-brown, pale at the joinings and lighter towards the pleuræ, with the tracheal trunk slightly reddish-purple grey; the other segments opaque: venter light cinereous, tinged with orange in segment 9 between the forceps-limbs, and in part of segment 8, and ochreous in segment 10. Forceps-limbs whitish, sometimes darker at the base. Setæ white. Femora olivaceous or dark olive-grey, pale yellowish at the knees; fore tibia and tarsus cinereous; hinder tibiæ and tarsi smoky grey, with the tarsal joinings either

carcely darker, or else narrowly black. Wings vitreous; neuration either pellucid vhitish, or fuscescent [perhaps according to the age of the specimen].

♀. Very similar. Length of body 6–8, wing 7–8·5, setæ, ♂ im. 14–16 mm.

Hab. England. Rills and streamlets on Ashbourne Green, Derbyshire, in June. Also t Woolbridge, Ringwood, Hants, in September. Distinguishable from *B. rhodani* by the minute dilatation or denticulation inside the extremity of the second joint of each orceps-limb, and the distinctness of the tubercle similarly situated in the first joint.

BAËTIS MELANONYX, Pictet. Plate LXIV. 17 (forceps).

Cloë melanonyx, Pict., Hist. Nat. Névropt. ii. Ephém. 258, pl. xl. 6 (1843–5).

Cloëon melanonyx, Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 574 (1853).

Baëtis finitimus, ! Etn., Trans. Ent. Soc. London (1871) 113, pl. v. 18, 18 a [detail].—*B. melanonyx*, *d., op. cit.* (1871) 118 [after Pict.].

Subimago (*living*) ♀.—Wings smoky grey, with dull greenish grey or suffuscous neuation. Setæ dark smoky grey, with rubiginose joinings. Fore femur and tibia greenish grey, varied with black at the knee, and with a dark cloud near the extremity of the former; tarsus dark grey, with black joinings and ungues. Hinder femora smoky cretaceous, with a faint nebulosity before the extremity; tibiæ smoky grey; tarsus dusky, with the joinings and the lesser of the ungues black. Oculi olivaceous, with a movable black spot.

Imago (*living*).— ♂. Turbinate eyes chocolate-brown on the summit, and narrowly so at the base of the light yellow pedicel; lower eyes dull subolivaceous. Notum jet-black. Abdomen fuscous above, darker or more opaque at the tips of segments 2–6, and throughout segments 7–10; venter somewhat griseous in segments 2–6, lighter in segments 7–9, pale ochraceous in segment 10 and inside the basal joints of the forceps; the remainder of the forceps blackish basewards, but lighter distally. Setæ somewhat greyish, with darker joinings near the roots. Fore femur olive-grey, the tibia and tarsus dull blackish grey; hinder legs rather lighter, with the tarsal joinings narrowly black; coxæ olive-grey. Wings vitreous, with metallic gramineous (=medium green oxide of chromium) and light carmine reflections; pterostigmatic space of the fore wing slightly smoky or subopaque; neuration translucent, the finer nervures in some lights subpiceous, the stronger tinged with olive-grey.

♀. Eyes subpiceous. Thorax dull black, or pitch-black, with paler sutures; tegulæ sulphur-yellow. Abdomen either fuscous or pitch-black above, with the first three joinings conspicuously pale, the next three piceous, and the others rufo-piceous; venter either dark bistre-grey with pale joinings, or greyish, with the last two segments often somewhat ochraceous, traversed lengthwise by a pale median line, and having a dark rounded spot at the base on each side of that line in every dark segment. Setæ dusky, with darker joinings. Fore femur olivaceous: hinder femora light greenish grey; tibiæ and tarsi in some lights dusky, with black joinings; in other lights those of the fore leg appear pitch-black, and those of the hinder legs pitch-brown; wings vitreous, with the greater part of the neuration pitch-black; subcosta and radius olive-grey. Length of body, ♂ 5–7, ♀ 8·5–9, wing, ♂ 6–7, ♀ 8·5–11; setæ, ♂ im. 12–18, ♀ 13–18 mm.

Hab. A common alpine species in N. Italy, Savoy, and Switzerland: in the neighbour-

hood of Samoëns (3400–5100 ft.) and Champéry (4500–5760 ft.), in streams or torrents having temperatures ranging in August and the beginning of September from 42°–51° F. in the early morning, to 45° and 59° F. (rarely 62°) in the afternoon: also in the Engadine at Pontresina and (M'Lach. 13 August) the Val de Fain: also (M'Lach.) in July on the St. Gothard route, Val Bedretta, and at Gex, Ain, &c.; also Oberseisenthal (Meyer-Dür) and Val d'Entremont (Pict. in June).

Baëtis alpinus, Pictet. Plate LXIV. 18 (forceps).

Cloë alpina, Pict., Hist. Nat. Névropt. ii. Ephém. 257, pl. xl. 5 (1843–5).

Cloëon alpina, Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 574 (1853).

Baëtis amnicus, ! Etn., Trans. Ent. Soc. London (1871) 117, pl. v. 24, 24 a [detail].—*B. alpinus*, *id.*, *op. cit.* (1871) 118 [after Pict.].

Imago (*living*).— ♂. Turbinate eyes chocolate-brown; lower eyes brown-black. Notum jet-black, with pale sutures. Dorsal segments of the abdomen fuscous, slightly paler at the joinings; venter mostly cinereous. Forceps black at the base, lighter distally. Setæ white or cinereous, with darker joinings near the roots. Fore femur greenish grey; tibia and tarsus smoky or dusky; hinder femora sometimes less of a greenish and more of an ochraceous tint, with a rufescent streak at the knee, the tibiæ commonly fawn-grey, and the tarsi dusky with black joinings. Wings vitreous, tinted slightly with extremely light brown-ochreous; neuration olive-black; pterostigmatic region of the fore wing somewhat obscured.

♀. Wings clear, with greenish grey neuration. Femora greenish grey or olivaceous; tibiæ, tarsi, and caudal setæ dusky. Length of body 7–10, wing 8–10; setæ, im. ♂ 16, ♀ 13 mm.

Hab. Common by mountain-torrents in Switzerland and Savoy; in the neighbourhood of Mt. Blanc at Barberine, Nant Bourant (4500 ft.), and Mottet in July; also at a stream from Mt. Brevent (Pict.) in August; also near the Chalets de Pitty, Samoëns (4700–5100 ft.) 8 A.M. 29 August, water 51° F., and near Les Clous, Champéry (4000 ft.). Also at La Rosa in the Bernina Pass (6000 ft.) 6·30 A.M. 25 August, water 51° F. Readily distinguished by the tint of the ♂ wings from *B. melanonyx*.

Baëtis buceratus, Etn. Plate LXIV. 19 (forceps).

Baëtis buceratus, ! Etn., Trans. Ent. Soc. London (1870) 5; ! *id.*, *op. cit.* (1871) 116, pl. v. 23, 23 a [detail].

Subimago & *Imago* (*living*).—Very similar to *B. vernus* and *B. tenax*; chiefly distinguishable from them by the ♂ forceps. The forceps-limbs in *B. buceratus*, divergent from one another in the first and second joints, again converge, and are also strongly arcuate beneath; the second joint of each limb is more domed than in those other species, and the terminal joint more nearly oval. Length of body, ♂ im. 8–9, wing 8–9, setæ 10–16 mm.

Hab. England. The Kennet and Holybrook near Reading, Berkshire, in April and May.

Baëtis pumilus, Burmeister. Plates XVI. 29 *e* (hind-wing) & LXIV. 20 (forceps).

? *Ephemera mutica* or [*Ephemera*], Linn., [Fn. Suec. ed. i. no. 752 (1746)]; *id.*, Syst. Nat. ed. x.

i. 547 (1758) ; *id.*, Fn. Suec. ed. ii. no. 1479 (1761) ; [Geof., Hist. Abrég. des Ins. . . . . Paris, ii. 240, no. 7 (1764)] = *E. striata*, Linn., Syst. Nat. ed. xii. pars ii. 907 (1767) ; Fab., Syst. Ent. 304 (1775) ; *id.*, Sp. Ins. i. 385 (1782) ; *id.*, Mant. Ins. i. 244 (1787) ; Berkenh., Outl. of the Nat. Hist. of Gt. Brit. & Ireland, ed. 2, i. 150 (1789) ; Vill., C. Lin. Ent. iii. 20 (1789) ; Gmél., Linn. Syst. Nat. ed. xiii. i. pars v. 2630 (1790) ; Ol., Encycl. Méth. vi. 420 (1791) ; Fab., Ent. Syst. emend. iii. pars i. 71 (1793) ; Cederh., Fn. Ingricæ Prodr. 135 (1798) ; Lat., Hist. Nat. d. Crust. & Ins. xiii. 99 (1805) ; Stewart, Elem. Nat. Hist. Anim. K. ed. 2, ii. 226.—? *E. ciliata*, Ström, N. Saml. Kongl. Dansk. Vidensk. Selsk. Skrift. ii. 91 (1783) ; Wallengren, Christ. Vidensk. Forhandl. no. ii. 22 (1880).

Cloë pumila, Burm., Handb. d. Ent. Bd. ii. Abth. ii. 799 (1839) ; Pict., Hist. Nat. Névropt. ii. Ephém. 253, pl. xl. 2 (1843–5) ; Brau., Neuropt. Austr. 26 (1857) ; Karsch, Die Insectenwelt, v. 402 (1863) ; ! Hag., Ann. Soc. Ent. Fr. (4) iv. 39 (1864) ; Meyer-Dür, Mitth. Schw. Ent. Ges. i. 221 (1864) ; Ausser., Ann. d. Soc. Natur. Modena, An. iv. 136 (1869)—? *C. striata*, Pict., Hist. Nat. Névropt. ii. Ephém. 270 (1843–5) ; Oulianine, Néuropt. & Orthopt. of Prov. of Moscow, 28 (1867).

Cloëon pumila, Walk., List. of Neuropt. Ins. in Brit. Mus. part iii. 573 (1853).—? *C. striata*, *id.*, *op. cit.* 576 (1853).

Baëtis pumilus, ! Etn., Trans. Ent. Soc. London (1871) 118, pl. v. 25–25*a* [details] ; ! *id.*, *op. cit.* (1873) 401 [mode of oviposition] ; Meyer-Dür., Bull. Soc. Ent. Suisse, iv. 310 (1874) ; Rostock, Jahresb. d. Ver. f. Naturk. Zwickau, 1877, p. 87 (1878).

Subimago (*living*).—Wings tinted with charcoal blackish. Legs greenish grey with light black-grey tarsi. Setæ light black-grey.

Imago (*living*).— ♂ . Turbinate eyes intense sepia-, or burnt-umber brown. Thorax jet-black above. Abdomen in segments 2–7 translucent white, the remainder yellowish pitch-brown above, umber-brown beneath. Forceps and setæ white. Legs white ; the fore femur, the tarsi, and the extremities of the tibiæ light black-grey. Wings vitreous.

♀ . Eyes olivaceous ; vertex of head traversed lengthwise by a double median rufo-piceous stripe. Thorax black or pitch-brown above. Abdomen above reddish pitch-brown, with the joinings, and sometimes with an abbreviated longitudinal line from the middle of the base between two curved lines in nearly every segment ochraceous ; venter paler, with a series of L-shaped warm sepia-brown marks or oblong rufo-piceous spots on each side of it. Setæ very light reddish brown-grey. Legs either almost uniformly pale grey, or else greenish grey with sepia-grey tarsi. Length of body 5–7 ; wing, ♂ 4–6, ♀ 6–8 ; setæ, ♂ im. 11–13, subim. 10, ♀ im. 7·5–10, subim. 7–10 mm.

Hab. Great Britain in streams and rivers. Widely distributed on the Continent, ranging from Scania and Norway (Wallengren) southwards to Portugal and Corsica (occurring at Cintra in April at about 380 ft., water 58° F. ; at Cea in the Estrella in June at 1800 ft., water 56° F. ; and at Villa Real, Traz-os-Montes in June at 1630 ft., water 58° F.) and eastwards to Armenia (Hag. Mus.). In Savoy and Switzerland it ranges from the lowlands up to about 5800 ft. in the neighbourhood of Champéry near the Chalets de Pas (5.15 P.M. 19 August, water 51° F.), and it is found in France, Germany, and Austria. The terminal joint of each of the forceps-limbs is oval or globular. The intermediate nerve of the hind wing is usually forked ; and the fork contains a simple veinlet from the terminal margin,

Baëtis niger, Linn. Plate XVI. 29*f* (forceps).

Ephemera nigra or [*Ephemera*], Linn., Fn. Suec. ed. ii. no. 1478 (1761) ; *id.*, Syst. Nat. ed. xii.

pars ii. 907 (1767); Fab., Syst. Ent. 304 (1775); [Schæf., Icon. Ins. circa Ratisbon. indig. ii. tab. cliv. 1, 2? (1776)]; Schr., Enum. Ins. Austr. indig. 305 (1781); Fab., Sp. Ins. i. 385 (1782); *id.*, Mant. Ins. i. 244 (1787); Vill., C. Lin. Ent. iii. 19 (1789); Gmél., Linn. Syst. Nat. ed. xiii. i. pars v. 2629 (1790); Rossi, Fn. Etrusc. ii. 8 (1790); Ol., Encycl. Méth. vi. 419 (1791); Fab., Ent. Syst. emend. iii. pars i. 70 (1793); Cederh., Fn. Ingricæ Prodr. 135 (1798); Walck., Fn. Paris, ii. 9 (1802); Panzer in Explic. Schæf. Icon. cliv. (1804); Lat., Hist. Nat. Crust. & Ins. xiii. 98 (1805); Stewart, Elem. Nat. Hist. Anim. K. ed. 2, ii. 225 (1817); Steph., Ill. Brit. Ent. vi. 67 (1835); Ronalds, Fly-fish. Ent. ed. i. pl. ix. 16–17 (1836); Blanch., Hist. Nat. Ins. iii. 54 (1840).

Cloë ‡ *diptera*, ! Ronalds, Fly-fish. Ent. ed. v. no. 16 (1856).

Baëtis niger, ! Etn., Trans. Ent. Soc. London (1870) 6; ! *id.*, *op. cit.* (1871) 119, pl. v. 26, 26*a* [detail].

Subimago (*living*).—Wings black-grey. Legs of the ♀ dull greyish white; ♂ femora very light yellowish green (prasinus); an abbreviated line or streak at the tip of the fore femur dark, the tibiæ and terminal joints of the tarsi greyish white, and the remainder of the tarsi fawn-colour. Setæ of ♂ grey, of ♀ cinereous.

Imago (*living*).— ♂ . Turbinate eyes reddish brown or light burnt-umber brown: lower eyes olivaceous. Thorax jet-black above. Abdomen in segments 2–7 translucent, and either white or light cinereous, with whitish or fuscescent joinings, and with the tracheal trunks darker; segments 8–10 either pitch-brown, reddish brown, or yellowish brown above, and either whitish, greenish grey, or fuscous beneath; nearly every ventral segment has two short divergent dark lines at its base, each followed by a dot. Setæ white or greyish white, often with opaque joinings, or with some of the proximal joinings faintly reddish. Forceps with finger-like limbs, dark grey at the base and then light greyish white. Fore femur either light greyish white, or dull greenish white, or light yellowish green; the rest of the fore leg greyish, with the distal extremity of the tibia reddish brown; hinder femora white, slightly tinged distally with yellowish, greenish, or grey; the tibiæ dull whitish and the tarsi greyish white, or both of them of this latter colour, with the distal edges of the tarsal joints black and the ungues piceous. Wings transparent; their neuration whitish pellucid, the subcosta and radius at the wing-roots piceous.

♀ . Eyes intense sepia. Dorsum of abdomen castaneo-piceous, with the terminal margins of the segments, and often with three short streaks at the base of each of segments 2–6, yellow ochreous: venter warm sepia, or burnt-umber brown, often with dark lateral L-shaped marks. Setæ either uniformly smoky or greyish white, or else greyish white with rufescent joinings. Legs greenish testaceous, with the tarsal joinings dusky. Length of body 5–7·5, wing 6–8; setæ, ♂ im. 9–11, subim. 9, ♀ im. 6–8·5, subim. 7 mm.

Hab. Rivers in England; May, June, and September. Also perhaps Sweden and Courland (Brauer). The second nervure of the hind wing is usually forked, as in *B. pumilus*.

NORTH AMERICAN SPECIES.

Baëtis ——.

‡ *Cloëon* ‡ *bioculata* [exempl. *g*], ! Walk., List of Neurop. in Brit. Mus. part iii. 573 (1853).

An undescribed species.

Hab. St. Martin's Falls, Albany River, Hudson's Bay (Brit. Mus.).

Baëtis posticatus, Say.

‡ *Cloëon posticata*, Say, Godman's West. Quart. Rep. ii. 162 (1824); Le Conte, Complete Writings of T. Say, i. 172 (1859).

Cloë posticata, Hag., Smithson. Miscell. Coll. (1861), Synop. Neuropt. N. Am. 53.

Bætis posticatus, Etn., Trans. Ent. Soc. London (1871) 120.

Imago, ♂.—Eyes reddish brown; thorax black; abdomen greenish white, hyaline, the last three segments fuscous; setæ white. Legs white, the fore femur obscure. Wings hyaline. Length of body 8, setæ 19 mm. (After Say.)

Hab. Shippingsport, 21st May. Common. (Say.)

Baëtis Hageni (renamed).

Cloë ‖ *unicolor*, Hag., Smithson. Miscell. Coll. (1861) Synop. Neuropt. N. Am. 54; Walsh, Proc. Acad. Nat. Sc. Philad. (1862) 380?; Hag., Proc. Ent. Soc. Philad. ii. 178 (1863) [nec *Cl. unicolor*, Curt. (1834)].

Bætis unicolor, Etn., Trans. Ent. Soc. London (1871) 120.

Imago (dried), ♀.—Body bronze-brown; legs pale luteous; setæ white; wings hyaline. Length of body 4; exp. of wings 10; setæ 10 mm. (After Hagen.)

Hab. Washington (Osten-Sacken). The translator of Dr. Hagen's Synopsis wrote "brassy" for "bronze." Walsh may have confounded another species with Hagen's.

Baëtis rubescens, Hag.

Cloë ‡‖ *unicolor*, Provancher, Natural. Canad. viii. 267 (1876); *id.*, Fn. Ent. Canad. ii. fasc. i. 84 (1877).—*C. rubescens*, Hag. MS., *id.*, *op. cit.* ii. fasc. i. 82[1] (1877).

Imago (♀? *dried*).—Body reddish brown, the abdominal segments margined with black behind; setæ whitish; legs pale yellowish; wings hyaline, reddish at the base and along the costal margin. Long. ·22 pouce=11·8 mm. (After Provancher.)

Hab. Not stated; probably Quebec. As this insect was taken by l'Abbé L. Provancher to be *Cl.* ‖ *unicolor*, Hag., which is a *Baëtis*, I infer that it also has 4 wings, and is referable to the same genus. But judging from the coloration of the mesothoracic wings, it might be a *Cloëon*, or even a *Callibætis*, if this genus ranges so far as Quebec.

Baëtis propinquus, Walsh.

Cloë ‡ *vicina*, Walsh, Proc. Acad. Nat. Sc. Philad. (1862) 380; *id.*, Proc. Ent. Soc. Philad. ii. 207, note 20 (1863).—*C. propinqua*, Walsh, *loc. cit.* (1863).

Bætis propinquus, Etn., Trans. Ent. Soc. London (1871) 121.

Subimago.—Wings fumose, with rather coarse and dusky longitudinal neuration; the cross veinlets concolorous with the membrane. Tarsi sometimes dusky.

Imago, ♂.—Lower portion of the oculi attached to the hinder "corner" of the turbinate portion. Thorax and last 4 dorsal segments of the abdomen piceous; the intermediate abdominal segments whitish hyaline, each with a dot at the sides; venter pale hyaline, the last 4 joints opaque whitish. Setæ whitish, the joinings near the base often fuscous. Legs pale, except the fore femur, which is sometimes pale ferruginous;

tips of tarsi cloudy. Wings and neuration hyaline; the space included between the two nervures of the hind wing subopaque.

♀. Thorax, and abdomen above, ferruginco-piceous, or sometimes ferruginous; venter reddish white. Fore femur always immaculate.

Length of body, ♂ 4–5, ♀ 3·5–5·5; exp. of wings 9–12; setæ, ♂ 7·5–10, ♀ 5–9 mm. [After Walsh.]

Hab. Rock Island, Ill.

Baëtis pygmæus, Hag.

Cloë pygmæa, ! Hag., Smithson. Miscell. Coll. (1861) Synop. Neuropt. N. Am. 54; *id.,* Proc. Ent. Soc. Philad. ii. 178 (1863).

Baëtis pygmæus, Etn., Trans. Ent. Soc. London (1871) 122.

Imago (*dried*), ♀.—Thorax dark fuscous; "abdomen fusco-griseous" (Hag.). Wings vitreous, with brownish neuration; fore wings with 6 simple straight cross veinlets, but no granulations, in the pterostigmatic space. "Legs and setæ white" (Hag.). Length of body, ♀ 3, expanse of wings 6 mm.

Hab. The St. Lawrence. The type reached me in an extremely fragmentary condition. [No. 79 in Hag. Mus.]

CENTRAL AND SOUTH AMERICAN SPECIES.

Baëtis Salvini, sp. nov. Plate XVI. 29*a* (wings and forceps).

Subimago (*dried*).—♀. Wings very light sepia-grey, with pitch-black neuration bordered with darker (Cologne earth) grey, the bordering transversely confluent here and there so as to form in the fore wing several (6–8) narrow fasciæ, some of which have a tendency to combine with one another in the vicinage of the most salient part of the curve of the terminal and inner margin; the marginal area contains usually 1 cross veinlet before the bulla, and 15–18 beyond it, which last are oblique, strong, and for the most part simple.

Imago (*dried*).—♂. Thorax fusco-luteous above, the metanotum piceous. Abdomen discoloured, perhaps flavescent or else light olivaceo-fuscous, with the apical borders of the segments pitch-black. Setæ very light sepia-grey, with about every fourth joint darker, annulated at every joining with sepia-brown. Wings vitreous: the fore wing with pitch-black neuration, the stronger nervures fuscescent towards the wing-roots; the membrane with a patch of that colour at the base of the wing, and most of the stronger cross veinlets bordered with the same, their borderings more or less confluent in the pterostigmatic space and the subjacent portion of the submarginal area. Fore femur light fuscous (light bistre-brown) banded with pitch-black near the middle and at its extremity; tibia and tarsus flavescent, the tibia just at the base and more broadly at its extremity, the tarsal joints annulated distally, and the ungues coloured throughout with

pitch-black. Hinder legs lighter in tint, but ornamented nearly in the same manner. Length of body, ♂ 10; wing, ♂ 12, ♀ 14; setæ, ♂ 26, subim. 20 mm.

Hab. Irazu, Costa Rica, 6000–7000 feet. (H. Rogers, Salvin and Godman Mus).

(?) Baëtis Stelzneri, Weyenb.

Cloë Stelzneri, Weyenbergh, Tijdsch. v. Ent. xxvi. 1882–3, p. 170 (1883).

Imago (living).— ♂. Upper portion of oculi dark red, the lower blackish grey. Thorax darker than in the ♀, so are the legs; pleuræ greyish yellow.

♀. Thorax sepia-brown, traversed longitudinally throughout the notum by a darker median line or stripe, and with much darker wing-roots. Abdomen pearl-grey beneath, and somewhat darker on the back, the colour there approaching steel-blue. Setæ (? 2) pearl-grey, the joinings as good as invisible. Wings unclouded, with almost black neuration. Length of body 5·5, wing 6, setæ 7·5 mm.

Hab. Cordova, Argentine Republic; summer and autumn, scarce. (After Weyenbergh).—From what is remarked of the wings, I conjecture this to be a species of *Baëtis.*

INDIAN AND CINGALESE SPECIES.

Baëtis ——.

‡ *Cloëon debilis,* ! Walk., Trans. Ent. Soc. London, N. S. v. 199 (1860).

Baëtis ‖ *debilis,* ! Etn., Trans. Ent. Soc. London (1871) 112 [nec ‡ *B. debilis,* Walk. (1853)].

Imago (dried).— ♀. "Fulva, capite nigro, abdomine testaceo; setis pedibusque albis, alis vitreis, venis albis."—An insufficiently described species, with 5 or 6 simple, oblique cross veinlets in the pterostigmatic portion of the marginal area of the fore wing. Length of body 5; expanse of wings 12 mm.

Hab. Hindostan (Walk., in Brit. Mus.).

Baëtis feminalis, sp. nov.

Imago (dried).— ♀. Wings vitreous, with pale pitch-brownish neuration; 2–5, generally simple and straight, fairly strong cross veinlets in the pterostigmatic space of the fore wing, without any interjacent granulations. Body bright reddish brown, the thorax polished; penultimate dorsal segment pale ochraceous, the other segments at the joinings dark or piceous; setæ pale warm sepia-brown, with grey joinings. Fore femur, for the most part, reddish piceous-brown, its apical margin and extreme base pale dull yellowish white; the base of the tibia of the same pale colour, the rest of the tibia and the tarsus light sepia-brown; hinder legs pale sepia-grey, or whitish tinged with yellowish; the femora broadly banded with reddish piceous-brown near their extremities.

♂. Subsimilar, but having the abdomen from segment 2 up to the basal half of segment 6 translucent, with piceous joinings; the tibiæ, tarsi, and bases of the hinder femora more nearly whitish; the setæ rather paler; and the neuration of the wings paler than in the ♀. Length of body, ♂ 4·5; wing, ♂ 5·5, ♀ 6; setæ, ♂ about 13·5, ♀ 8 mm.

Hab. Rainbodde, Ceylon, at altitudes of not less than 4000 feet (Hagen Mus.). All

traces of hind wings in the 4 specimens (Nos. 34, 49, 50, 51) had disappeared, if they ever had existed at all.

Baëtis consuetus, Hagen.

Cloë consueta, ! Hag., Verh. zool.-bot. Gesells. Wien, viii. 477 (1858); Etn., Trans. Ent. Soc. London (1871) 131; Hag., *op. cit.* (1873) 403.

Subimago (*dried*).—Wings transparent, tinted throughout with very pale smoky grey; neuration opaque light brown, the cross veinlets in certain postures seeming darker than the longitudinal nervures. Legs pale brownish-yellowish, the fore femur tinged with reddish brown towards its extremity. Setæ warm sepia-grey or fuliginous. Mesonotum very pale yellowish brown in the middle; the pleuræ fuscous; pectus and venter pale ochraceous; dorsum of abdomen discoloured, but dark and paler along the middle.

Imago (*dried*).— ♂. Wings vitreous; some of the longitudinal nervures yellowish at the base; the pterostigmatic space of the fore wing contains 2–5 simple straight cross veinlets, without any granulations between them. Hind wing trinerved. Mesonotum lutescent; sides of the thorax dark brown-ochre; pectus and venter ochraceous; dorsum of the abdomen varied with dark reddish brown and pale ochraceous,—the paler colour forms large blotches in the midst of segs. 2–7, and some longitudinal linear streaks near the spiracles, leaving on each side of these segments a broad dark longitudinal stripe continuous with that of the thorax; the joinings of these segments, and the whole dorsum of the subsequent segments dark reddish brown. Legs pale amber-colour; the fore femur indistinctly annulated with reddish brown close to or at its extremity.

♀. Very similar; but the dorsum of the abdomen is darker, with piceous joinings; setæ sepia-grey, with some of the joinings towards their roots darker. Tibia and tarsus of the fore leg sepia-grey. Length of body, ♂ 3–4, ♀ 4·5; wing, ♂ 4·5–5, ♀ 5–6; setæ ♂ subim. 9 mm.

Hab. Rainbodde, Ceylon, at altitudes of 4000 feet and upwards (Hagen Mus.). With the types of this species, and from the same locality, stood a single example of probably a different species, marked 41, characterized as follows:—

Imago (*dried*).— ♂. Wings vitreous, with pale yellowish-brownish perspicuous neuration; 4–8 slightly curved, cross-veinlets in the pterostigmatic space of the fore wings, linked together by a somewhat sinuous row of adventitious veinlets near the costa, which thus give rise to a series of cellules, but there are no granulations between the cross veinlets. Thorax polished, bright brown-ochreous. Abdomen in segments 2–6 translucent ochraceous white, pitch-brown at the joinings; segment 7 ochraceous; segments 8–10 brown-ochreous; venter pallid, subochraceous. Setæ sepia-grey, with dark joinings. Legs dull pale testaceous; fore femur tinged slightly with golden-brown, the tibia and tarsus fumatose. Commensurate with *B. consuetus.*

Baëtis solidus, Hagen.

Cloë solida, ! Hag., Verh. zool.-bot. Gesells. Wien, viii. 477 (1858); Etn., Trans. Ent. Soc. London (1871) 131.

Subimago (*dried*).—Wings transparent, pale sepia-grey; neuration for the most part

translucent and concolorous, but sometimes subopaque; the subcosta and radius of the fore wing, the base of the costa, and the wing-roots, subopaque and pallid, or pale yellowish brown. Legs in ♀ lutescent, rather more dingy in colour in the ♂. Setæ pale warm sepia-brown, with opaque joinings. Thorax in ♂ luteous or lutescent, varied with paler; abdomen above luteous or brown-ochre, darker or more of a reddish brown at the sides of the segments and in the midst of their hinder extremities; venter ochraceous yellow.

Imago (*dried*).— ♂. Wings vitreous, with light brown neuration; 3–6, subregular, mostly simple, oblique cross veinlets in the pterostigmatic space of the fore wings, somewhat attenuated or tabescent towards the subcosta; between them, almost midway between this last and the costa, is extended a single series of granulated rudimental longitudinal veinlets, rarely branched, but somewhat irregular. Hind wing binerved. Thorax yellowish testaceous, varied near the peak of the mesonotum with flavescent. Dorsum of abdomen partially brown-ochre, with dark spots at the stigmata; segments 2–5 or 6 translucent at the sides and towards the base, their extreme hinder borders piceous; segments 9 and 10 pale. Venter and forceps pale yellowish ochraceous; the 8th segment and the forceps towards their extremities dark; setæ whitish, tinged with pale sepia-grey, and having several of their basal joinings dark reddish brown. Femora amber-colour, gradually darkened and more distinctly tinged towards their tips with reddish testaceous; tibiæ and tarsi testaceous, the ungues, and the extreme terminal margins of the intermediate joints of the hinder tarsi, rubiginose. Length of body 4; wing 4·5–5 mm.

Hab. Rainbodde, Ceylon, at altitudes of 4000 feet and upwards (Nos. 23, 27–30, and perhaps 52 in Hag. Mus.). The specimen numbered 52 has the neuration and terminal margin of the fore wings piceous; and the neuration is stronger than that of any of the other examples.

A Nymph allied to *Centroptilum*, *generis incerti*.

Nameless Nymph. Plate XLV. (whole figure and details).

Abdominal tracheal branchiæ all somewhat alike in form, ovate-lanceolate and acute, traversed lengthwise by an irregularly pinnately branched trachea. Antennæ defective in the type specimens, shorter than the head and thorax combined. Median caudal seta subequal to the others in length, which are about $\frac{1}{2}$ as long as the body; the fringes are narrowed acuminately to the points of the setæ. Mandibles nearly as in *Baëtis*. Palpus of maxilla I. longer than the lacinia; the terminal joint minute, the others long and slender, the first about $\frac{4}{5}$ as long as the second; the lacinia armed at the point with about two teeth, preceded on the inner edge by fasciculated setulæ of nearly uniform length. Labium and maxillæ II. nearly as in *Baëtis*; but the palpi are not indented at the joining of the oval-pointed terminal joint with the penultimate joint, which is well defined; the proximal joint of the same is subequal in length to the other two combined. Tongue truncate at the base, broadly emarginate in front; the median lobe dilated distally and mucronate; the much narrower paraglossæ slightly expanded, with curved lateral borders

that meet the apical margin at an acute angle. Hind tarsus, claw excluded, very nearly of the same length as the tibia; the leg, as a whole, rather longer than the fore leg. Length of body 8, setæ 4 mm.

Hab. Puno, Peru; from a spring (A. Agassiz, Mus. Comp. Zool. Cambridge, Mass.).

CENTROPTILUM, Etn., 1869.

Illustrations. Adult (details), Pl. XVII. 30, *a–c*, and LXIV. 21; (whole figure) see citations of Pictet (1843–5) under *C. luteolum* (*Cloë translucida*), and *C. lituratum*. *Nymph.*, Pl. XLVI.

Adult.—Hind wing oblique, elongate, and narrow, with the apex commonly obtuse, rarely acute, and usually with the costal projection acuminate [acute in *C. stenopteryx*]; neuration limited to 2 simple longitudinal nervures. Fore wing devoid of colour-ornamentation, free from cross veinlets in the marginal and submarginal areas as far from the great cross vein as the bullæ, and with the intercalar veinlets of the terminal margin in a large majority of the species single [paired in *C. Poëyi*]; neuration, as a whole, similar to that of species of *Cloëon* or *Baëtis*. Forceps-limbs of ♂ mostly after the pattern of *Cloëon*, which differs from that of the normal *Baëtis* in the greater relative plumpness of joint 2, in the slight terminal enlargement of joint 3, and in joint 4 being clavate or papilliform instead of oval; *C. tenellum* (Pl. XVII. 30 *c*) is the only known deviation from this type of forceps in the genus. The interval between the bases of the forceps-limbs varies in relative width with the species. Intermediate abdominal segments of ♀ subequal in length. Caudal setæ in ♂ im. $1\frac{2}{3}$–2, in ♀ im. about $1\frac{1}{3}$, in subim. 1–$1\frac{1}{2}$ as long as the body. Fore tarsus of ♂ rather longer than the tibia, which is about twice as long as the femur; its joints in diminishing sequence rank 2, 3, 4, 5, 1; fore tarsus of ♀ nearly $\frac{9}{10}$ as long as the tibia, which is almost as long as the femur; its joints in shortening succession rank 2, 3, subequal to 5, 4, 1. Hind tarsus of ♂ about $\frac{7}{9}$ as long as the tibia; the joints (longer in the ♀) rank 1, 4, 2, 3. *Nymph.*—Abdominal tracheal branchiæ acute, the foremost narrowly obovate-lanceolate, the others more broadly ovate, each traversed lengthwise by an irregularly pinnately branched trachea. Antennæ longer than the head and thorax combined. Outer caudal setæ almost $\frac{1}{2}$ as long as the body, the median about $\frac{1}{3}$ as long as it, all shortly tail-pointed in the typical species. Mandibles armed with slender fang-like teeth; endopodite absent, or represented by a minute tuft of hair. Palpus of maxilla I. slightly longer than the lacinia, 3-jointed, with slender joints of nearly equal length; the lacinia terminated by fang-like teeth, preceded on the inner edge by an even series of setulæ inserted at nearly equal intervals. Laciniæ of maxillæ II. falcate, scarcely wider than the somewhat subulate lobes of the labium; proximal joint of the palpus rather shorter than the remainder, which are compressed; terminal joint squarely truncate, oblong, quadrangular, and barely more than $\frac{1}{2}$ as long as the second. Tongue similar in form to a closed ecclesiastical biretta; the median lobe broader than the paraglossæ, and minutely mucronate. Hind tarsus, claw excluded, subequal in length to the tibia; the leg altogether about $1\frac{1}{9}$ as long as the fore leg. *Habits*, those of *Baëtis*.

Type. *C. luteolum* (in *Ephemera*), Müller.

Distribution. Europe; Hudson's Bay Territory, Arizona, and Cuba.

Etymology. κεντρωτός and πτίλον, from the usual spur-like form of the costal projection of the hind wing.

The nymph of the typical species was identified by observation in the field; but probably I reared it also. The older description was based upon specimens in ill condition, still in my possession. The foremost tracheal branchiæ were described as "subulate;" but this was due to their having been deformed by the preservative fluid.

CENTROPTILUM LUTEOLUM, Müller. Pl. XVII. 30 *a* (wings, ♂, head & forceps).

Ephemera luteola, Müll., Zool. Dan. Prodr. 113 (1776).—*E. caudata*, Ström, N. Saml. Kongl. Dansk. Vidensk. Selsk. Skrift. ii. 91 (1783); Wallengren, Christ. Vidensk. Forhandl. No. ii. 21 (1880).

Cloëon ochraceum, ! Steph., Ill. Brit. Ent. vi. 68 (1835); Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 578 [*C. ochracea*] (1853).—*C. hyalinatum*, ! Steph., Ill. Brit. Ent. vi. 69 (1835); Walk., List &c. 579 [*C. hyalinata*] (1853).—*C. albipenne*, ! Steph., Ill. Brit. Ent. vi. 69 (1835); Walk., List &c. 579 [*C. albipennis*] (1853).—*C. translucida*, Walk., *op. cit.* 574 (1853).—*C. halterata*, *id.*, 577 (1853).—*C.* ‡ *bioculatum*, Hag., Ent. Ann. (1863) 34; ! Etn., Ann. & Mag. Nat. Hist. (3) xviii. 117, fig. [hind-wing] (1866).

Cloë halterata, Burm., Handb. d. Ent. Bd. ii. Abth. ii. 798 (1839); ! Ramb., Hist. Nat. d. Ins. Névropt. 299 (1842).—*C. translucida*, ! Pict., Hist. Nat. Névropt. ii. Ephém. 255, pl. xl. 3, 4 (1843–5).—*C. ochracea, hyalinata & albipennis*, Pict., *op. cit.* 271 (1843–5).

Baëtis luteolus, ! Etn., Ent. Mo. Mag. v. 88 (1868).

Centroptilum luteolum, ! Etn., *op. cit.* vi. 132 (1869); ! *id.*, Trans. Ent. Soc. London (1871) 108, pls. ii. 8 [part of fore wing] & v. 13, 13 *a* [details]; Hag. & Etn., *op. cit.* (1873) 400; Meyer-Dür, Bull. Soc. Ent. Suisse, iv. 310 (1874); Rostock, Jahresb. d. Ver. f. Naturk. Zwickau, 1877, p. 86 (1878).

Subimago (living).—Wings very faintly grey-tinted, sometimes very slightly tinged with the palest yellow-ochre. Femora light yellow-ochre, tibiæ cinereous, tarsi dusky. Setæ greyish white or cinereous.

Imago (living).—♂. Turbinate eyes bright light red; lower eyes subolivaceous. Notum either bistre-, or pitch-brown, or black. Abdomen vitreous in segments 2–7, spotted faintly with raw sienna (furfuraceous) on each side near the tips of the dorsal segments, or sometimes wholly of that colour thereabouts; the other segments opaque, rich brown-ochre, raw sienna, or bistre-brown above, with the distal edges of segments 8 and 9 yellow-ochreous; beneath pale, tinged with very light Mars-yellow distally. Setæ and forceps white. Femora cretaceous; tibiæ and tarsi greyish, or smoky white. Wings vitreous; longitudinal nervures faintly tinged with yellowish.

♀. Eyes olivaceous, greenish black, or black. Notum bistre- or olive-brown. Abdomen above either raw sienna (sometimes modified with light yellow-ochre) or Mars-yellow, or olive-brown, with dark subcutaneous tracheæ in segments 2–6; venter pale. Setæ white or greyish white. Femora either light greenish yellow, banded almost imperceptibly in the middle with reddish (this band is invisible in dried specimens), with the tibiæ and tarsi olive-grey; or femora light yellowish, tibiæ and tarsi greyish white. Length of body 5–7; wing 6–7·5; setæ, ♂ im. 10–14, subim. 7, ♀ im. 8–9, subim. 6 mm.

Hab. Europe from Hammerfest and Alten to Portugal and N. Italy: also N. America,

in Hudson's Bay Ter. [probably St. Martin's Falls, Albany river]. This species is abundant in Great Britain, and reaches maturity in the southern counties from April to November. It is found in Germany, Switzerland, and France (at Dijon, M'Lach.), in addition to the countries quoted above: it is common at Pallanza along the shore of the Lago Maggiore (640 ft.), and near Cintra in the valley N. of the town (385 ft.). The acute projecting point noticeable above the forceps [the limbs of which are nearly contiguous at the base], and the sharpness of the hind wing are preeminently distinctive of *C. luteolum*. The terminal joints of the forceps-limbs are straight. Female specimens are sometimes distinguishable from *Cloëon rufulum* only by their possessing hind wings.

Centroptilum lacustre, sp. nov.

Imago (*living*).— ♂. Very similar to *C. pennulatum*, but with the turbinate eyes red, and with the tips of the transparent abdominal segments less strongly coloured.

♀. Eyes light olive-grey. Body light brownish ochre; this colouring in segments 2–6 of the dorsum is restricted to a median triangle projecting forwards from the hinder border of each segment, leaving the remaining parts pale; their subcutaneous tracheæ are dark; segments 7–10 uniformly light brownish ochre; venter pale. Setæ white. Legs nearly colourless, but faintly tinged with yellowish at the tips of the femora. Wings vitreous; the pterostigmatic portion of the marginal area of the fore wing contains 6–9 simple cross veinlets. Length of body 5·5–6; wing 6–7; setæ, ♂ im. 12–14, ♀ im. about 10 mm.

Hab. Pallanza on Lago Maggiore (640 ft.); at the lake side, about sunset on the 18th July. The forceps and hind wing are very like those of *C. pennulatum*.

Centroptilum pennulatum, Etn. Pl. XVII. 30 *b* (♂, head, legs, hind wings and forceps).

Centroptilum pennulatum, ! Etn., Trans. Ent. Soc. London (1870) 2; ! *id., op. cit.* (1871) 139. pl. v. 14, 14 *a*; Rostock, Jahresb. d. Ver. f. Naturk. Zwickau, 1877, p. 85 (1878).

Subimago.—Wings a very little greyer than those of *C. luteolum*: distinguishable from that species chiefly by its greater stature.

Imago (*living*).— ♂. Turbinate eyes light cadmium-orange; lower eyes olive-grey or black. Pronotum dusky, or light luteo-fuscous; meso- and metanotum either light luteo-fuscous, raw sienna, or bistre-brown. First dorsal segment of the abdomen piceo-fuscous; segments 2–6 vitreous, tinged at the joinings very faintly with Mars-orange; segments 7–10 reddish brown-ochre or reddish chestnut-brown, modified with Chinese-orange above, but ochraceous white beneath. Setæ and forceps white. Legs white, with the tips of the femora yellowish white, and with the terminal tarsal joints faintly tinged with very light sepia-grey.

♀. Eyes olive-grey, or greenish black; vertex of head light yellow, with a broad median burnt-sienna stripe from the anterior ocellus to the occiput, and with the orbits of the ocelli black. Notum light dull brownish ochre modified with bistre-grey. Abdomen in dorsal segments 2–6 bistre-grey, in 7–10 reddish brown-ochre, with the usual abbreviated median line and two short divergent pale lines in segments 2–8, with the tips of segments 2–7 either brown-ochreous modified more or less with Mars-orange, or deep reddish brown, or narrowly piceous, and with streaks of the same colour pro-

duced forwards at the sides in the form of triangular spots; tracheæ dark; venter spotless, pale, coloured in segments 8 and 9 with light ochraceous tinged slightly by the pleuræ with Mars-orange and reddish. Femora whitish amber; tibiæ greyish white; tarsi dark grey, with black ungues. Setæ white. Wings vitreous; the marginal area of the fore wing, beyond the bulla, contains in the pterostigmatic region of ♀ 11–13 sub-simple and nearly straight cross veinlets; in that of ♂ are 7–8. Length of body or wing 8–9; setæ, ♂ im. 14–17, ♀ im. 11 mm.

Hab. Great Britain, from near Lumphanan in Aberdeenshire southwards; common near Thorncombe, Dorset, in June, and generally in trout-streams from August to October. Hind wing somewhat ligulate, with the tip elliptical. Forceps-limbs close together at the base; their terminal joints pyriform, slightly incurved, smaller, and narrower towards the base than in *C. luteolum*. The edge of the penis [or penis cover ?] is saliently curved.

Centroptilum nemorale, sp. nov.

Imago (*living*).— ♂. Turbinate eyes intense Mars-yellow (*peropace testaceus* of Müller's code) on the summit, paler at the sides; lower eyes olive-grey. Notum very light fusco-ochraceous; the first dorsal abdominal segment more fuscous. Abdominal segments 2–6 translucent white, their dorsal terminal margins, like segments 7–9, brown-ochre; segment 10 rather yellower than these; venter in segments 7–10 whitish ochre. Forceps (the limbs are nearly in mutual contact at the base), setæ and legs translucent white; femora very faintly tinged with yellowish just at their distal extremities. Wings vitreous; in the pterostigmatic portion of the marginal area of the fore wing are 4–5 simple cross veinlets with indistinct rudiments of one or two others. Length of body 6·5; wing 7; setæ 14 mm.

Hab. Italy; in the chestnut-wood below Gavinana, San Marcello, Apennino Pistojese, near a streamlet (2550-2750 ft.); captured, by beating, at about 10 A.M., 26 July. The hind wings and ♂ genitalia resemble those of *C. pennulatum*; but the colour of the turbinate oculi, and the smaller number of cross veinlets in the pterostigmatic portion of the fore wing suffice to distinguish *C. nemorale*.

Centroptilum pulchrum, sp. nov.

Imago (*living*).— ♂. Turbinate eyes bright chrome-lemon yellow; lower eyes light olive-grey or olive-green. Notum furfuraceous or raw sienna, with the peak of the mesonotum chrome-lemon. Abdomen in segments 2–6 perspicuous, narrowly tinged with raw sienna by the joinings at the tips; the other segments above either brown-ochre modified with Chinese orange, or else raw sienna, with the usual pale paired dorsal lines; venter in segments 7–10 very light brown ochre or yellow ochre in the middle. setæ translucent white; forceps dull whitish. Femora white; tibiæ and hinder tarsi greyish white; the smaller ungues black. Wings vitreous; in the pterostigmatic portion of the marginal area of the fore wing are 4–10 almost invariably simple cross veinlets.

♀ (*dried*).—The colour-differences of this sex are quite of the ordinary description,

and need not be detailed. Length of body, ♂ ♀ 5·5–8; wing 6–8·5; setæ, ♂ im. 11–16, ♀ im. 11 mm.

Hab. France; in a tributary of the Loire, near Brive (Haute Loire), 24th Sept.; the Garonne by the Pont d'Empalot, Toulouse, 21st Aug. The hind wing and ♂ genitalia resemble those of *C. pennulatum*; but the terminal joints of the forceps-limbs are rather stouter and shorter than those of that species, and are more like the terminal joints of the forceps of *Cloëon simile*.

Centroptilum lituratum.

Ephemera ‡ *culiciformis*, Scop., Ent. Carniol. 264 (1763).
Cloë litura, Pict., Hist. Nat. Névropt. ii. Ephém. 260, pl. xli. 1–3 (1843–5).
Cloëon litura, Walk., List of Neuropt. in Brit. Mus. part iii. 574 (1853).
Centroptilum lituratum, Etn., Trans. Ent. Soc. London (1871) 109.

Subimago.—Wings dull yellowish grey. Setæ fuscous (*brun*).

Imago.— ♂. Turbinate eyes light cadmium or sulphur-yellow. Metathorax traversed lengthwise by a black streak, which does not quite reach the hind border; the mesothorax [? metathorax] has two dots of the same colour. Abdomen light rufo-fuscous, rather darker towards the tip, and with a row of spots on each side. Setæ lutescent, annulated with black. Fore and hinder legs uniformly lutescent. Wings vitreous with pale neuration.

♀. Eyes black. Body yellow-ochreous, with two little reddish lines on the mesothorax, and some spots on the sides of the abdomen. Length of body 8; setæ, ♂ im. 12 mm.

Hab. At the base of Mt. Salève, in autumn. [After Pictet.] The streak on the mesothorax distinguishes the ♂ of this species from *C. pulchrum*.

Centroptilum stenopteryx, Etn.

? *Ephemera albipes & parvula*, Scop., Ent. Carniol. 264 (1763); Vill., C. Lin. Ent. iii. 22 (1789); Ol., Encycl. Méth. vi. 421 (1791).
Centroptilum stenopteryx, ! Etn., Trans. Ent. Soc. London (1871) 110, pl. v. 15, 15 *a* [details].

Subimago (*dried*).—Wings and setæ light sepia-grey.

Imago (*dried*).—Notum light brownish ochre, browner in the ♂. Body very much discoloured through age. Setæ white. Wings vitreous; the stronger nervures slightly tinted with dull yellowish amber near the roots; in the pterostigmatic portion of the marginal area of the fore wing are 6 or 7 cross veinlets, which are nearly always simple and straight, besides occasionally one or two rudiments at the costa; but one of the ♀ examples has most of them forked and anastomosing with each other. Length of body, ♂ 4, ♀ 4·5; wing 4–5·5; setæ, ♂ im. 9, ♀ im. 5 mm.

Hab. Carinthia (Zeller MS. in McLach. Mus.).

Centroptilum tenellum, Alb. Plate XVII. 30 *c* (forceps).

Centroptilum tenellum, ! Albarda, Ent. Mo. Mag. xv. 128 (1878).

Imago (*dried*), ♂.—[Turbinate eyes *during life*, Roman sepia or clove-brown; lower eyes

black-brown.] Notum either fuscous or pitch black. Dorsal segments 1 and 7–10 of the abdomen either deep chestnut-brown or pitch-brown; segments 2–6 either translucent, light sepia or Cologne-earth grey with the joinings dark, or else cretaceous; venter in segments 7–9 light Roman sepia-brown. Setæ and forceps whitish. Legs translucent whitish; fore leg faintly tinted with brownish, varying with change of light to whitish amber; the femur with a well-defined pitch-brown band at the tip separated by a short clear space from an ill-defined greyer band a little beyond the middle; tibia brownish in the vicinage of the distal articulation; ungues in some lights brownish: hinder femora banded with pitch-brown at the knee only, the adjoining part of the tibia brownish at the articulation, the tarsal joinings and ungues also light pitch-brownish. Wings vitreous: the great cross vein and the bases of the nervures included between it and the thorax pitch-brown; in the pterostigmatic portion of the marginal area of the fore wing are 5 or 6 simple cross veinlets, and between them and the bulla are rudiments of 2 or 3. Length of body 3–4; wing 4·5; setæ, ♂ im. 7–8 mm.

Hab. Holland, near Arnhem (Van Medenbach de Rooy, 8th Sept.). I subsequently met with it there, between the town and the railway bridge below the town on 26th July, and at first mistook the species for *Baëtis niger*, on account of its coloration and its finger-like forceps-limbs.

AMERICAN SPECIES.

Centroptilum Poëyi, sp. nov.

Imago (*dried*), ♂.—Thorax above lutescenti-fuscous or pitch-brown; abdominal segments 2–6 transparent whitish; the spiracles and tracheal trunks darker in individual specimens; segments 7–10 purple-sepia brown above, paler beneath; setæ white, with their joinings towards the base brownish. Wings vitreous; the principal longitudinal nervures brownish near the wing-roots; the costa, subcosta, and radius, very faintly brown amber; the terminal margin and finer nervures, in certain lights, brownish grey; about 6 nearly straight and simple cross veinlets in the pterostigmatic space; interneural veinlets of the terminal margin mostly in pairs. Legs whitish; the fore femur throughout, the hinder femora distally, slightly yellowish; fore tibia and tarsus light sepia-grey, hinder tarsi and ungues less distinctly so. Length of body 4, wing 4 mm.

Hab. Rangel Mountains, Cuba (Poëy & Ch. Wright) [Hag. Mus.]. The wings of a carded *subimago* are of a light sepia-grey.

A small undescribed species of *Centroptilum* from Arizona (1 ♀ im., 2 subim., in M'Lach. Mus.) has likewise paired interneural veinlets along the greater part of the terminal margin of the fore wing.

CLOËON, Leach, 1815.

Illustrations. *Adult* (details) Pl. XVII. 31*a–d*; (whole figures) see under *C. dipterum*, citation of Stephens (1835) and [*Cloë*] Pictet (1843–5). *Nymph* Pl. XLVII.; see also under *C. dipterum*, citations of [*Ephemera*] De Geer (1771), Goring and Pritchard (1829), Bowerbank (1833), Blanchard (1840), of [*Ctoë*] Calori (1848), and of [*Cloëopsis*] Vayssière (1882); also under *C. rufulum* of [*Chloëon*] Lubbock (1863 & 1865).

Adult.—Hind wings absent. Wings, of some species only, in the ♀ or in both sexes, varied with colour in the marginal and submarginal areas, and provided with cross veinlets between the great cross vein and the bulla; but other species have the wings of the ♂ or of both sexes devoid both of colour and of cross veinlets in the parts specified; intercalar rudimentary veinlets of the terminal margin single in a large majority of the species; cross veinlets of the disk disposed, as in *Baëtis*, mainly in 3 dislocated series in front of the cubitus (5) and 2–3 behind, many of them thickened slightly in the females of some of the species. Forceps-limbs of ♂ 4-jointed; the basal joint short, relatively very stout, gibbous at the base and suddenly contracted near the distal joining on the inner side; the second joint less stout and larger at its base than at its further extremity; the third joint comparatively long and slender; swollen a little at the end; the fourth joint minute, clavate or papilliform. Penis not yet observed. Intermediate abdominal segments of ♀ subequal in length. Caudal setæ in im. ♂ about 2, in ♀ 1–1½ as long as the body, in subim. ♂ about ⅔, ♀ about ⅘ as long as it. Fore tarsus of ♂ nearly 1⅓ as long as the tibia, which is almost of the same length as the femur; its joints in order of lessening length rank 2, 3, 4, 5, 1; fore tarsus of ♀ (exclusive of joint 1) little more than ¾ as long as the tibia, which is about 1$\frac{1}{10}$ as long as the femur; its joints rank 2, 3 subequal to 5, 4,—1 being extremely short and intimately combined with the tibia. Hind tarsus of ♂ about ¾ as long as the tibia; its joints, shorter than in the ♀, rank 1, 4, 3, 2.

Nymph.—Abdominal tracheal branchiæ all foliaceous and slightly oblique, and all double excepting the hindermost; each of the double ones is formed of two unequal divisions slightly connate at the base, containing somewhat palmately partite trachee with long branches and short branchlets; of these divisions the larger, broadly subrotundate, is more or less subtruncate along the costal border and displays a small contracted sinus at its posterior base; the smaller division exhibits a similar sinus thereabouts, and a wide shallow sinus or excision on the opposite side near the tip; the single one of each series is subrotundate, with a shallow recess in place of the basal sinus, and with the opposite margin towards the tip slightly retuse, and is supplied by a single trachea divided nearly to the roots into two main branches with unilateral branchlets. Antennæ longer than the head and thorax combined [in *C. rufulum* of equal length with the body]. Setæ subequal to each other and to the body in length, fringed for at least halfway to the tips from the roots, with the ends of the fringes gradually shortened to points, and then tail-pointed, the proportionate length of the fringeless tail-points varying with the species. Mandibles terminated by compressed denticulate teeth; endopodite absent. Palpus of maxilla I. longer than the lacinia, 3-jointed; first joint as long as the second, and almost twice as long as the third; the lacinia armed with slender fang-like teeth at the tip, preceded by two evenly arranged divergent series of setulæ along the inner edge. Laciniæ of maxillæ II. falcate, narrower than the acutely lanceolate lobes of the labium; proximal joint of the palpus a little shorter than the remainder, which are dilated distally and slightly compressed; the terminal joint obliquely truncate at the end and acute at the extremity. Median lobe of the tongue obtusely rounded, broader than the paraglossæ. Hind tarsus, claw excluded, a little shorter than the tibia, and this scarcely more than ½ as long as the femur; the whole leg about 1⅛ as long as the fore leg. Resident in still or sluggish

water; two-brooded. In southern Europe *C. dipterum* inhabiting warm sites has been observed to be ovi-viviparous.

Type. C. dipterum (in *Ephemera*), Linn.

Distribution. Temperate and tropical regions of the northern hemisphere; Australia; southern Africa; the Argentine Republic, and Chili.

Etymology obscure.

The nymph has been reared; those of *C. dipterum*, *C. rufulum*, *C. simile*, and of one of the Portuguese species have been examined by me. Through some oversight, the proximal joint of the tarsus of the ♂ intermediate leg has been omitted in Pl. XVII. In the original camera-lucida drawing its length corresponds exactly with that of the homologous joint of the hind tarsus.

CINGALESE SPECIES.

CLOËON MARGINALE, Hagen.

Cloë marginalis, ! Hag., Verh. zool.-bot. Gesells. Wien, viii. 177 (1858) & ix. 206 (1859) [excl. ♀ im.]; Etn., Trans. Ent. Soc. London (1871) 132, note.

Subimago (*dried*).—Thorax dull luteous; abdomen dull pitch-brown above, lighter at the sides; venter testaceous; setæ sepia-grey with black joinings. Wings transparent, tinted throughout very faintly with light bistre-grey, excepting in the marginal and submarginal areas, which are fuscous; neuration light brownish. Hinder legs testaceous in opaque view, changing in transmitted light to yellow-amber; fore femur luteous. [Nos. 38 and 39 in Hag. Mus.]

Imago (*dried & fragmentary*).— ♂. Thorax above fuscous or bistre-brown. Dorsum of abdomen in segments 8–10 either of a similar or else of a redder brown; segments 2–7 translucent whitish anteriorly, edged with bistre-brown at the tips, and extensively suffused with bistre-grey before the tips, the dark colouring appearing in some examples to project forwards in a pointed streak on each side from the tip of the segment; venter of a light colour, narrowly edged with a dark colour at the joinings, but apparently free from other markings. Forceps similar to those of *C. dipterum*; a small dark acute projecting point is visible above the interspace between the forceps-limbs, as in that species. Fore femur, in opaque view, light brown-ochreous, with a dark band before the tip; tibia and tarsus of a rather dark amber tint. Hinder legs in opaque view of a light yellowish amber tint, with dark ungues and sometimes faintly obscured tarsi, and with a faintly defined dark spot, or fine abbreviated longitudinal streak, a little before the tip of the femur; knee opaque. Wing vitreous, very faintly amber-tinted in the marginal and submarginal areas; the great cross vein pitch-brown, or rufo-piceous, towards the subcosta; longitudinal neuration light brownish amber; cross veinlets whitish. In the marginal area are no cross veinlets before the bulla, but usually 2 or 3 straight ones in the pterostigmatic region.

♀. Wing vitreous, coloured with light bistre-brown in the marginal and submarginal areas. Neuration light brownish, excepting such of the cross veinlets as are distributed in advance of the sector (4), which are whitish in most lights; those situated in the coloured areas have extremely narrow translucent edging. The marginal area contains

no cross veinlets before the bulla, and usually 2–5 straight ones in the pterostigmatic space. Length of body or wing, ♂ im. 4–4·5, ♀ im. 5·5 mm.

Hab. Rainbodde, Ceylon, at altitudes of 4000 ft. and upwards (Hag. Mus. & McLach. Mus.). The ♀ imago (No. 40, Hag. Mus.) formerly attributed to this species is a *Teloganodes tristis*.

Cloëon, sp. (nameless).

Subimago (*dried*), ♂.—Mesothorax dark brown-ochre in the middle, lighter at the sides; body discoloured, reddish brown or reddish piceous. Wings transparent, uniformly pale warm sepia-grey; neuration translucent, brown; some of the interneural adventitious veinlets in the neighbourhood of the pobrachial and anal nervures spring from the terminal margin in pairs; 4 cross veinlets in the pterostigmatic space, and 7 in the nearer portion of the marginal area (*i. e.* before the bulla). Fore leg with the femur lutcous, the tibia and tarsus lutescent, and the extreme terminal edges of the tarsal joints darker: hinder legs very pale lutescent; the femur banded with greyish before the tip, and marked with a grey spot or dot on the outer side just by its extremity. Length of body 5, wing 6 mm.

Hab. Rainbodde, Ceylon, at upwards of 4000 ft. (No. 33 in Hag. Mus.).

Cloëon bimaculatum, sp. nov., Etn. MS., in the writing of Pl. XVII. 31 *d* (wing ♀ im.).

Imago (*dried*).—♂. Thorax above piceous; abdomen discoloured; setæ whitish or brownish white, with black joinings and annulations. Fore femur reddish brown, the tibia and tarsus lighter and rather yellower; hinder femora brownish amber, the tibia and tarsus nearly of the same colour. Wings transparent with light brownish longitudinal neuration (excepting the costa, subcosta, and radius, which are dull light yellowish in tint, and only faintly coloured) and white cross veinlets; at the base of the costal area is a reddish brown spot extending to the wing-roots; in the pterostigmatic region a light bistre-brown spot, containing a clear space and traversed by white cross veinlets, occupies the marginal and submarginal areas to their extremities; the space intervening between these two spots along the front of the wing is faintly tinged with light yellowish brown: in the marginal area are about 4 cross veinlets between the great cross vein and the bulla, and 7 or 8 beyond this, all simple.

♀. Very similar. The cross veinlets in the front portion of the wing thickened as in *C. dipterum*, ♀. Length of body 5–5·5; wing 5·5–6; setæ, ♂ 13 mm.

Hab. Ceylon (Thwaites, in McLach. Mus.).

EUROPEAN SPECIES.

Cloëon dipterum, Linn. Pls. XVII. 31 *a* (forceps and ♀ fore-leg and hind feet), XLVII. 22 (caudal setæ, nymph).

Ephemera diptera, or [*Ephemera*], [Réaum., Mém. pour serv. à l'hist. des Ins. vi. pl. xlv. 1 (1742); ? Pontop. (1753 & 4), and Naturhist. Dan. p. 223, pl. xvii. (1765)]; Linn., Fn. Suec. ed. ii. no. 1477 (1761); *id.*, Syst. Nat. ed. xii. pars ii. 906 [excl. obs.] (1767); [De G., Mém. d. Ins. ii. pars ii. 656, pl. xviii. 1–9 (1771)]; Fab., Syst. Ent. 304 (1775); *id.*, Sp. Ins. i. 385 (1782); Retz., Gen. & Sp. Ins. no. 184 (1783); Fab., Mant. Ins. i. 244 (1787); Raz., Hist. Nat. du Jorat, p. 210 (1789); Vill., C. Lin. Entom. iii. 20 (1789); [Zsch., Mus. Lesk. i. 150, no. 19 (1789)]; Gmél., Linn. Syst. Nat. ed. xiii. i.

pars v. 2630 (1790); Ros., Fn. Etrusc. ii. 9 (1790); Ol., Encyc. Méth. vi. 420 (1791); Fab., Ent. Syst. emend. iii. pars i. 71 (1793); Schr., Fn. Boica, ii. pars ii. 199 (1798); Lat., Hist. Nat. Crust. et Ins. xiii. 99 (1805); Shaw, Gen. Zool. vi. pars ii. 253 (1806); Lat., Gen. Crust. et Ins. iii. 184 (1807); Cuv., Règn. An. ed. 1, iii. 430 (1817); Lamarck, Hist. Nat. An. s.-vertèb. ed. 1, iv. 221 (1817); Sam., Ent. Comp. p. 259 (1819); Cuv., Règn. An. ed. 2, v. 244 (1829); Zet., Ins. Lap. col. 1046 (1840); Voigt, Lehrb. d. Zool. v. 311 (1840); Blanch., Hist. Nat. Ins. iii. 55 (1840); Dufour, Mém. par divers savans, Inst. de France, viii. 580 note (1841); Lat., Nouv. Dict. d'hist. Nat. x. 319 (1847); Verloren, Mém. Couron. Acad. Roy. Belg. xix. 49, pl. i. (1847); Blanch., Cuv. Règn. An., ed. Crochard, xii. 92 (1848); Carus, Icon. Zootom. tab. xv. 6 [anatomy] (1857).—*E. annulata* & *E.* ‡ *striata*, Mull., Zool. Dan. Prod. 143 (1776).—*E.* ‡ *marginata*, Gor. & Prit., Nat. Hist. Obj. for Mieros. [*ed. i.] ed. iii. 61–9, pl. ii. 4–6 (1829); Bowerb., Ent. Mag. i. 239–44, pl. ii. 1–6 (1833); Lacord., Introd. à l'Ent. ii. 77 (1838); Brullé, Blanch. Hist. Nat. Ins. i. p. xxiv. (1840) [nymph].—*E.* ‡ *culiciformis*, Fonscol., Ann. Soc. Ent. Fr. (2) iv. 49 [misprinted *calciformis*] (1846).

Cloëon pallida, Leach MS., Brewst. Edinb. Encyc. ix. 137 (1815); Sam., Ent. Comp. 259 (1819).—*C. marmoratum* [♀ im.] & *obscurum* [subim.], Curt., Lond. & Edinb. Phil. Mag. (3) iv. 121 (1834).—*C. cognatum* !, ‡ *dimidiatum* !, & *consobrinum* !, Steph., Ill. Brit. Ent. vi. 69 (1835); Walk., List of Neurop. Ins. in Brit. Mus. part iii. 579 [misprint. *cognata*] (1853) [♂ im.].—*C. virgo*, ! Steph., Ill. &c. p. 70 (1835); Walk., List &c., p. 580 (1853) [♂ im.].—*C. dipterum*, Leach MS., Brewst. Edinb. Encyc. ix. 137 (1815); Curt., Lond. & Edinb. Phil. Mag. (3) iv. 121 (1834); ! Steph., Ill. Brit. Ent. vi. 68, pl. xxix. 3 (1835) [misprint. *diptera*); Walk., List &c. p. 575 (1853); Hag., Ent. Ann. 1863, p. 29; Etn., Ent. Mo. Mag. v. 87 (1868); *id.*, Trans. Ent. Soc. Lond. (1871) p. 102, pl. v. 10 [forceps]; Hag., *op. cit.* (1873) p. 399 [nymph]; Meyer-Dür, Bull. Soc. Ent. Suisse, iv. 311 (1874); ! McLach., Trans. Ent. Soc. Lond. (1875) 171; Palmén, Morphol. Trach.-Syst. SS. 1–21 & 28, taf. i. 7–9 [anatom.] (1877); Rostock, Jahresb. d. ver. f. Naturk. Zwickau (1877) p. 80 (1878); Palmén, Paar. Ausf. gänge d. Geschl. org. b. Insect. S. 64 [anatom.] (1884).

Cloë diptera, Burm., Handb. d. Ent. Bd. ii. Abth. ii. 798 (1839); ! Piet., Hist. Nat. Névropt. ii. Ephém. 266, pl. xliii. (1843–5); Schn., Stet. Ent. Zeit. vi. 340 (1845); Calori, Nouv. Ann. Sc. Nat. Bologna (2) ix. 38–53, pls. ii.–iii. [viviparition] (1848) [translat. Joly, Bull. Soc. d'Etud. Sc. Nat. Nimes, 5e ann. No. 8 [Sep. pp. 1–18] pls. ii, iii. (1877); Brau., Neuropt. Austr. 26 (1857); Leunis, Synop. Naturgesch. Thierreichs, ed. 2, p. 636 (1860); Karsch, Die Insectenwelt, v. 400–2 (1863); Gerstäck., Handb. d. Zool. ii. 59–61 (1863); Hag., Ann. Soc. Ent. Fr. (1864), p. 39; *id.*, Ent. Mo. Mag. ii. 25 (1865); Ed. Piet., Névropt. d'Espag. 25 (1865); Oulianine, Neuropt. & Orthopt. prov. Moscow, p. 27 (1867); Ausser., Ann. del. Soc. Natur. Modena, Ann. iv. 135 (1869); ! Joly, Bull. Soc. d'Et. Sc. d'Angers, 1876 [*Sep.* p. 42] note D [vivipar.] (1876); ! *id.*, Bull. Soc. d'Etud. Sc. Nat. Nimes, 5e Ann. no. 8 [*Sep.* pp. 21–25] notes B–I (1877); ! *id.*, Bull. Soc. d'Etud. Sc. d'Angers, 1878–80, pp. 169 & 172 (1880); Ciaccio, Rendicont. del. session. del. Accad. d. Scien. ec. di Bologna (1880) [anatom.].—*C. affinis*, ! Ramb., Hist. Nat. Névropt. 298 (1842) [♂ im.].—*C. cognata* & *virgo*, Piet., Hist. Nat. Névropt. ii. Ephém. 272 (1843–5) [♂ im.].—*C. apicalis*, ! Costa, Atti d. R. Acad. d. Sc. fisic. e mathemat. di Napoli, ix. 34 (1882) [♂ subim.].

Chloëon dipterum, Lubbock, Trans. Linn. Soc. xxv. pl. lix. 19–21 (1865).

Cloëopsis diptera, ! Etn., Ann. & Mag. Nat. Hist. (3) xviii. 146 [excl. var.] (1866).

Subimago (*living*), ♀.—Wings light blackish grey or dusky. Oculi dark fusco-olivaceous. On each side of the venter, in segments 2–7 in the ♀ (2–8 in the ♂) is a rubiginose longitudinal line; the lines are represented by two dashes at the base of the 9th segment in the ♀.

Imago (*living*).—Wings colourless in the ♂, ornamented in the ♀ with amber-colour along the costa; the marginal area in the ♂ is free from cross veinlets as far as the

pterostigmatic space, but this contains 3–5 simple and usually straight cross veinlets, and sometimes rudiments at the costa of 2 or 3 others interspersed between these; in the ♀ there are about 6 before the bulla, and 10 with a few rudiments beyond it. The interval between the basal joints of the forceps-limbs in the ♂ is moderately wide, and behind [or above] it is a dark minute subconical point [penis ?]; the terminal joints of the forceps-limbs are proportionally shorter than in other European species.

♂. *Variation* 1. Turbinate eyes dull light reddish, or reddish clove-brown, above; at the sides sulphureous or flavescent: lower eyes traversed by a dark line; above it either brown-black or greyish clove-brown, with a movable dark spot; below it and towards the orbit paler. Notum pitch-black or jet-black. Dorsum either piceous or fuscous or rufo-fuscous throughout, with the distal edges of the segments narrowly ochraceous or whitish; or else only so in segments 7–10, and in segments 2–6 partly translucent, each of these segments being whitish or cinereous towards the base and of the prevalent ground-colour distally, the dark colour extending forwards as a triangular projection on each side almost to the base of the segment, and sometimes also as a tapering streak in the middle of the back; venter dark cinereous with whitish joinings, usually marked with two longitudinal linear stripes in every segment excepting the last; but these stripes are sometimes reduced to mere spots in the joinings. Setæ white or greyish white, with black joinings and annulations, the latter often coinciding with every alternate joining towards the base of the seta, and with every fourth or fifth joining afterwards, but sometimes the alternation is uniform throughout. Legs variable in colour: the fore legs either dull whitish tinged with cretaceous in the distal portion of the femur, and with cinereous in the tibia and tarsus; or with the femur greenish grey and the tibia and tarsus blackish grey; the femur in either case has a rufescent spot or a pitch-brown annulation near its distal extremity: hinder legs whitish or cretaceous, the femoral marking often indistinct, the distal edges of the first, second, and third tarsal joints (or sometimes the whole of the third joint) and all but the extreme base of the fourth joint, black or dark grey. Wing-neuration sometimes almost colourless excepting at the wing-roots, usually piceous. Forceps cinereous, with the proximal joint fuscous.

♂. *Variation* 2. Differs from the preceding chiefly in being below the average in size, and in having segments 2–7 of the dorsum greyish anteriorly and rubiginose at the tips, with a triangular streak recurrent on each side from every dark apical border.

Hab. Belgium.

♂. *Variation* 3. Turbinate eyes bright yellow (*flavus*). Tergum of thorax brown-ochreous, the peak of the mesonotum light yellow-ochreous preceded by a pair of short brown-purple dashes tapering forwards. Abdomen in segments 2–7 translucent white, with some fine linear streaks along the spiracular line, a spot on each side of the dorsum of the 5th segment, a corresponding tapering stripe on each side of the 6th segment meeting a narrow half-effaced marginal band lying along the middle of the distal edge of the segment, a trifid spot on the 7th segment formed by a more strongly marked corresponding band and lateral stripes in conjunction with a median longitudinal stripe, the stripes extending to the base of the segment, and all but the extreme lateral portions of the dorsum in segments 8 and 9, Indian red; the 10th segment and the 9–7th ventral

segments very light yellow-ochre or yellowish white, with the usual pair of linear streaks in the 8th segment and two corresponding spots at the base of the forceps in the 9th segment, Indian red. Setæ white, with some of the joinings narrowly greyish. Legs and wing-neuration whitish, the femora faintly tinged with yellowish distally, their reddish markings reduced to an almost invisible dot in the hinder femora, and an almost obliterated band in the fore femur.

Hab. Italy, at Legnano (25 July).

♂. *Variation* 4. Turbinate eyes dull yellow-lake. Notum piceous. Otherwise very similar to Vars. 1 and 3.

Hab. Tessin; above Locarno (1670 feet, 15 May 1884), several examples.

♀. Rather variable in general coloration; sometimes luteous or lutescent, with a rosy suffusion, sometimes of a rosy fawn-colour or rosy-grey, and liable (whatever the prevalent tint may be) to a more or less extensive infiltration of chlorophyll in parts of the head, thorax, and abdomen, and in their appendages. Eyes olivaceous, traversed by two dark stripes; vertex of head with a red or red-purple stripe on each side from the lateral ocelli along the orbits of the oculi to the occipital margin; a quadrangular double spot of the same colour in the middle of the pronotum. Meso- and metanotum sometimes variegated with light fuscous, sometimes uniformly luteous or piceous. The 9th dorsal abdominal segment is either lighter or darker in colour than the others; segments 2–8 have reddish or piceous markings on a lighter ground-colour, viz.:—a longitudinal tapering median streak from the base to about the middle of the dorsum of the segment, or a continuous linear stripe down the middle of the back; also sometimes a transverse marginal band across the tip of the segment (but this is exceptional); also an unequally bifid spot on each side extending from the base to the tip of the segment (or at least as far as the distal joining), the longer upper division of which tapers upwards and backwards either as a curved linear stripe, or more usually, as a curvilinear trilateral, while the smaller lower and linear division runs nearly horizontally a little above the spiracular line; the curved stripes last mentioned coalesce with the distal median marginal band (when that is present) and, being met by the corresponding stripes of the contiguous segments, form together with them a kind of chain pattern along the back. All of the ventral segments (excepting the last two) are bilineated longitudinally with reddish or piceous, but the 9th segment has two dots at its base in the place of the stripes; the former segments commonly have an abbreviated longitudinal dark line on each side at the base, close to the spiracular region, which is sometimes joined by a narrow band to the adjacent linear stripe so as to form an L-shaped mark. Setæ usually coloured as in the ♂, or with the ground-colour reddish white; but, in some examples, at a short distance from their origin they become more strongly annulated, the dark colour occupying the whole of every alternate joint and some portion of the extremities of the other joints. The legs are more strongly marked than in the ♂, and when tinged with yellowish the fore femur is of a gamboge or yellow-ochre changing to light brown ochre in dead specimens; the hinder femora are of a light amber-colour, and the tibiæ and tarsi are of an extremely light brown-ochre or testaceous hue. The wing-membrane from the costa to the radius, and in the distal extremity of the area enclosed between

the radius and the sector, is of a brown amber-colour, or light fuscous, excepting along the borders of the cross veinlets, where it remains pellucid and white; the costa, subcosta, and radius are concolorous with the membrane, excepting sometimes the subcosta and the radius near the wing-roots, where, with the great cross vein, they are often fuscous or piceous; the cross veinlets in advance of the sector, including those also in the submarginal and marginal areas, are opaque white; the remainder of the neuration is piceous, excepting sometimes that the cross veinlets nearest the wing-roots and posterior to the pobrachial nervure (7) are also white; the cross veinlets in the disk of the wing are much stouter than the nervures in this sex. Length of body, ♂ 5–10, ♀ 8–11; wing, ♂ 6–11, ♀ 9–12; setæ, ♂ im. 13–20, subim. 9–14, ♀ im. 12–15, subim. 12 mm.

Hab. Europe, from Scania and Norway (Wallengren) southwards to the borders of the Euxine and Mediterranean; Madeira, in pools left in the lower parts of the beds of streams in the neighbourhood of Funchal (22 Nov. 1880), first collected by Wollaston; Teneriffe, common near the Jardin Botanico, Orotava (15 Dec. 1880); Egypt (Savigny, and F. Walker !); Armenia (Hag. Mus.); Japan (McLach. Mus.). In Great Britain, clean ponds that acquire a rather high summer temperature are frequented by this species; at Paris, tanks for Nymphæaceæ and other water-plants in the Jardin des Plantes are its favourite resorts. Hitherto instances of viviparation on the part of *C. dipterum* have been observed only in the warmer parts of Italy and France.

The occurrence of species closely related to *C. dipterum* in N.W. India, and in the Knysna, S. Africa, was recorded by me in Trans. Ent. Soc. London (1871), p. 103; there is also one in Australia.

Cloëon simile, Etn. Plates XVII. 31 *b* (adult wing, ♂ legs and forceps), XLVII. no. 2 (details of nymph).

Cloë || *obscura*, ! Ramb., Hist. Nat. d. Ins. Névropt. 297 (1842).

Cloëon || *obscurum*, ! Etn., Trans. Ent. Soc. London (1871) 104.—*C. simile*, ! *id.*, *op. cit.* (1870) 2; ! *id.*, (1871) 103, pls. ii. 7 & v. 11 [details]; Rostock, Jahresb. d. Ver. f. Naturk. Zwickau, 1877, 81 (1878).

Subimago (*living*).—Wings mouse-grey, tinged with yellowish in a slight degree along the costa and at the base; the nervures somewhat raw sienna in colour. Setæ piceous. Oculi of ♂ subolivaceous.

Imago (*living*).—♂. Turbinate eyes olivaceous or dark greenish sulphureous; lower eyes either pitch-black or greenish black. Notum either jet-black or fuscous. Abdomen pitch-brown above; venter cinereous, faintly tinged with yellowish towards the tip. Setæ rusty white, with reddish joinings. Forceps greenish white; the limbs nearly contiguous at the base; penis-cover (or penis?) gently curved distally, not acute like that of *C. dipterum*. Legs olivaceous with greyish or blackish tarsi; the fore tibia greenish grey. Wings vitreous; the subcosta and radius of the fore wing somewhat straw-colour or bright amber-yellow; the pterostigmatic portion of the marginal area contains numerous (about 9–11) cross veinlets, slightly irregular in their curvature and sparingly conjoined; there are none before the bulla in either sex.

♀. Eyes black. Head castaneous in the vicinage of the ocelli, with two longitudinal

lines or stripes of the same colour upon the vertex; the facial carina has two small piceous tubercles on each side. Abdomen luteo-fuscous or raw umber above, with the terminal edges of the segments testaceous or very light brown-ochreous, and with dark subcutaneous tracheæ; venter olivaceous, with the last two segments tinged somewhat with straw-colour or light yellow-ochre. Legs olive-green, with darker tibiæ and tarsi. Length of body 9–10; wing, ♂ 8, ♀ 10–11; setæ, ♂ im. 14–15, subim. 9, ♀ im. 10–14, subim. 7–9 mm.

Hab. Great Britain, in still water and in sluggish streamlets, during September and October. France, Autun (M'Lach.). Portugal, at Almodovar, Alemtejo (600 ft., 7 May), water 65° F.; São Marcos da Serra (580 ft.); and Silves, Algarve (about 130 ft., 16 May). Also in Switzerland at the Statzer-See, near St. Moritz in the Engadine (about 6000 feet, 16 August; M'Lach.). The name *obscurum* was preoccupied in this genus by Curtis [under *C. dipterum*].

Cloëon concinnum, sp. nov.

Imago (*living*).— ♂. Turbinate eyes dull light yellow or chrome-lemon (*flavus*); lower eyes olive-grey. Notum raw sienna or furfuraceo-luteous. Abdomen in segments 6–10 concolorous above with the notum, with paler joinings; segments 2–5 dirty white, suffused with the same colour as the remainder, the main tracheæ conspicuously dark; venter in segments 8–10 somewhat ochraceous. Setæ and forceps whitish; the limbs of the latter almost contiguous at the base. Hinder femora yellowish white; hinder tibiæ and tarsi smoky white or whitish sepia-grey; fore leg rather darker. Wings vitreous. *When dried* the neuration acquires a faint dull amber tint in certain lights; the pterostigmatic region of the wing, likewise very faintly amber-tinted and of slightly turbid translucidity, contains usually 11–13 rather irregular cross veinlets (of which a few are forked towards the costa and some anastomose with one another), seldom so small a number as 7–9 (counted at the subcosta): the fewer the cross veinlets, the more they are branched and anastomose; there are none before the bulla in either sex.

♀ (*dried*).—Very similar to the ♂. The cross veinlets of the pterostigmatic portion of the marginal area, more regular in this sex, are usually 10–12, seldom 8 in number; and the membrane thereabouts is more transparent than in the ♂; between the strictly pterostigmatic region and the bulla are sometimes a few (about 4) indistinct rudiments of cross veinlets. In dried examples of either sex the legs become more opaque than those of living specimens; femora sublutescent in opaque view, changing in transmitted light to light yellowish-amber; fore tibia and tarsus of ♂ in some lights olive-grey; hinder tibiæ whitish amber in transmitted light, nearly concolorous with the femora in other lights; hinder tarsi of ♂ rather yellower than the tibiæ, with the terminal joint either brown-ochreous or olive-grey, and black ungues; tarsi of ♀ often suffused with green. Setæ dull whitish, with faintly opaque joinings; in ♂ examples the setæ sometimes become faintly tinged with light brown-ochre. Length of body 7·5–8; wing 8–9; setæ, ♂ im. 14–16, ♀ im. 11 mm.

Hab. Portugal: the stream near Porcalhota, at the junction of the road from Mafra with that between Lisbon and Cintra (480 ft., 1st June 1880, shortly before sunset, water

66° F.). Distinguishable from *C. simile* by the colour of the legs and the bright colour of the ♂ oculi; and from *C. rufulum* by having the ♂ forceps-limbs close together at their insertion, by the greater irregularity of the pterostigmatic cross veinlets &c. In the absence of the subimago, and without direct comparison of dried examples with Rambur's type, it is impossible to pronounce an opinion as to the likelihood or otherwise of this species being identical with the following.

Cloëon subinfuscatum, Rambur.

Cloë subinfuscata, ! Ramb., Hist. Nat. d. Ins. Névropt. 298 (1842).

Cloëon? halterata, var., Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 577 (1853).—*C. subinfuscatum*, ! Etn., Trans. Ent. Soc. London (1871) 104.

Subimago (dried).— ♀. Wings tinted with dark ivory-black-grey, with luteous longitudinal nervures; the pterostigmatic portion of the marginal area contains about 12 sparingly forked cross veinlets; there are none before the bulla. Thorax lutescent; legs rather light brown-ochre. The joinings of the setæ dark. Length of body, ♀ 9; wing 11 mm.

Hab. Provence (*Ramb.*).

Cloëon rufulum, Müller. Plates XVII. 31 *c* (forceps), XLVII. no. 1 (nymph and details).

Ephemera rufula, Müll., Zool. Dan. Prodr. 143 (1776).—*E.* ‡ *culiciformis* and ‡ *striata*, Blanch., Hist. Nat. des Ins. iii. 55 (1840).—*E.* ‡ *bioculata*, Blanch., Metamorph. &c. des Ins. p. 127, fig. [misdrawn] (1868).—*E.* ‡ *vulgata*, Gegenbaur, Grundz. d. Vergleich. Anat. 138, fig. 112 A (1870) [tracheal syst.], reproduced in Balfour, Comp. Embryol. i. 339, fig. 188 A (1880).

Cloëon dimidiatum, Curt., Lond. & Edinb. Phil. Mag. (1834) 121; Hag., Ent. Ann. (1863) 32.—*C. dimidiata*, Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 580 (1853).—*C. russulum*, ! Etn., Trans. Ent. Soc. Lond. (1871) 105, pl. v. 12 [detail]; Hag. & Etn., *op. cit.* (1873) 400; Rostock, Jahresb. d. Ver. f. Naturk. Zwickau, 1877, p. 81 (1878).

Cloë ‡ *pumila*, ! Ramb., Hist. Nat. d. Ins. Névropt. 298 (1842).—*C. dimidiata*, Piet., Hist. Nat. Névropt. ii., Ephem., 272 (1843–5).—*C.* ‡ *bioculata*, Blanchard, Metamorph. &c. des Ins. p. 127, fig. (1868).

Chloëon dimidiatum, Lubbock, Trans. Linn. Soc. Lond. xxiv. 61–67, pls. xvii., xviii. (1863), and *op. cit.* xxv. 477–92, pls. lviii., lix. (1865).

Cloëopsis ‡ *diptera*, var., ! Etn., Ann. & Mag. of Nat. Hist. (3) xix. 401 (1867).

Subimago (living).—Wings extremely light greyish or greyish white, often tinged with bright green [green oxide of chromium] along the stronger nervures. Setæ light greyish.

Imago (living).— ♂. *Variation* 1. Turbinate eyes Roman-sepia brown. Thorax jet-black above. Abdomen dark fuscous, with pale yellowish joinings, and with the tracheal ramifications black. Setæ white, with dull reddish joinings. Forceps white, light blackish grey distally. Legs pale greenish-yellow, with light dusky tarsi.

♂. *Variation* 2. Turbinate eyes dull lemon-yellow, or dull sulphur-yellow; lower eyes fuliginose, or olive-grey, or glaucous. Thorax above pitch-brown, or fusco-luteous, or brown-ochreous, or almost raw-sienna yellow. Abdomen in segments 2–6 or 7 translu-

cent white, with the edges of the dorsal vessel, a spot on each side of it on every joining, and a cloud over the tracheal ramifications, dull reddish; the tracheal trunk pitch-black; segments 7–, or 8–10, above, either pitch-brown, or fusco-luteous, or fuscous, or almost burnt-sienna red, sometimes with the joinings ochraceous; venter in segments 7–10 ochraceous white, sometimes with a pair of abbreviated dark lines beneath the ganglionic cord at the base of each segment but the last, and with a dark line immediately beneath the spiracular ridge. Forceps and setæ white. Legs either wholly white, or with the fore femur greenish grey, the fore tibia and tarsus grey or greyish white, the hinder femora white tinged with very light yellow or sulphureous, and the hinder tibiæ and tarsi dull white. Wings vitreous; the marginal area in its pterostigmatic portion contains 6–8 oblique cross veinlets, sometimes sparingly forked near the subcosta; there are none before the bulla in either of the sexes.

♀ (*living*).—Eyes cæsious, or dark olive-grey, or light greenish grey, or brown-black. Vertex of head light yellow, with a double longitudinal median reddish or brown-ochreous stripe from the frons to the occipital margin. Thorax above sometimes very light dull brown-ochre, sometimes very light yellowish, sometimes bistre-brown, sometimes jet-black; the peak of the mesonotum often tinged with bright green. Abdomen sometimes fuscous, sometimes olive-grey, sometimes in such examples tinged distally with light brown-ochre, and sometimes uniformly of this last colour: the lighter segments (2–7) either have each a small spot in the middle, two at the apical margin, and an indistinct curved line on each side of the back, or have a small spot in the middle of the back, and a larger triangular spot on each side distally, of the same yellowish or furfuraceous colour; the subcutaneous tracheæ, and a streak close by every spiracle, are black. Venter lighter than the dorsum, and sometimes paler anteriorly than in the hinder segments, sometimes reddish white. Setæ white. Fore femur sometimes greenish- or olive-grey; hinder femora greenish white; tibiæ and tarsi white, with the terminal tarsal joints cinereous. Wings vitreous, often tinged at the base with bright green. Length of body 5–9; wing 6–10; setæ, ♂ im. 13–15, subim. 9, ♀ im. 10–12, subim. 6–8 mm.

Hab. Europe from Scania (Wallengren) and Great Britain to Switzerland and southern France; profusely abundant in Holland near Gouda &c. and in Belgium; common in Saxony (Rostock); also at Basle (M'Lach.), near Visp in Canton Valais; and in the neighbourhood of Orthéz in the Basses Pyrénées. The forceps-limbs are wider apart at the base than in our other native species, and their terminal joints more slender. The identity with this species of the Chinese specimen referred to below is open to question.

Cloëon sinense, Walker [Catalogue-name only].

‡ *Cœnis sinensis*, ! Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 584 (1853).

Cloëon ‡ *russulum*, ! Etn., Trans. Ent. Soc. London (1871) 105, var. 2 [part.].

Hab. Northern China. A single adult ♂ in the British Museum, insufficiently described, is very similar to, if not identical with, *C. rufulum*.

AMERICAN SPECIES.

Cloëon mendax, Walsh.

Cloë mendax, Walsh, Proc. Acad. Nat. Sc. Philad. (1862) 381.
Cloëon mendax, Etn., Trans. Ent. Soc. London (1871) 106.

Subimago, ♂.—Wings and their neuration subopaque and slightly dusky. Setæ pale. Turbinate eyes pale; lower segment of oculi blackish (Walsh).

Imago, ♂.—Pale ferruginous; sternum and venter pale greenish hyaline, the latter opaque at the tip. Legs pale, tips of tarsi cloudy. Wings and neuration hyaline; isolated veinlets of the terminal margin all single. The ♀ sometimes has the thorax tinged with green, and is always paler above. (After Walsh.)

♀ (*dried*).—Body light yellowish ochraceous above, sometimes very light, and commonly liable to infiltration of chlorophyll, especially at the roots of the setæ, the peak of the mesonotum, the wing-roots, the knees, and the tarsi. Venter whitish ochraceous; the main tracheæ of the abdomen often blackened. Setæ white. The marginal area of the wing has no cross veinlets between the great cross vein and the bulla; in the pterostigmatic space are 4–8 cross veinlets (usually 6) from the costa, mostly simple, rather oblique, and almost straight, very rarely anastomosing with one another to any extent, many of which do not reach the subcosta; and usually, between them, a few rudiments of others issue from the costa. Length of body 4–5, wing 5–6 mm.

Hab. Rock Island, Ill. (Walsh); Denham, Mass. (McLach. Mus.); Detroit, Mich. (Mus. Comp. Zool., Cambridge, Mass.). May and June.

Cloëon vicinum, Hagen.

Cloë vicina, Hag., Smithson. Miscell. Coll. (1861) Synop. Neuropt. N. Am. 54; *id.*, Proc. Ent. Soc. Philad. ii. 178 (1863).
Cloëon vicinum, Etn., Trans. Ent. Soc. London (1871) 107.

Imago (*dried*).—♂. Thorax fulvous (Hag. 1861) or reddish brown (*id.* 1863); abdomen whitish hyaline, with the last 3 segments fuscous above; setæ whitish. Wings colourless. Legs whitish, the fore legs fulvous at the base.

♀. Body yellowish white; setæ and legs whitish; wings hyaline. Length of body 4; expanse of wings 10; setæ, ♂ 10, ♀ 6 mm. (After Hagen.)

Hab. Washington (Osten-Sacken).

? Cloëon dubium, Walsh.

Cloë dubia, Walsh, Proc. Acad. Nat. Sc. Philad. (1862) 380; Hag., Proc. Ent. Soc. Philad. ii. 178 (1863).
Cloëon dubium, Etn., Trans. Ent. Soc. London (1871) 106.

Mr. Walsh diagnosed this species from *Baëtis propinquus* (which it closely resembles) by its smaller dimensions &c.

Imago.—♂. Thorax and last 4 dorsal segments piceous: these last, beneath, opaque whitish; the intermediate abdominal joints transparent whitish, each with a dark dot on each side, whose centre is hyaline. Legs pale, the tips of the tarsi cloudy. Wings

and their neuration colourless; the intercalar veinlets of the terminal margin in pairs.

♀. Thorax, sternum, and abdomen above pale ferruginous; venter pale yellowish or greenish; femur of the fore leg always more or less ferruginous. Length of body 2·5–4; expanse of wings 8–10·5; setæ, ♂ 4·5–5·5, ♀ 3–4·5 mm. (After Walsh.)

Hab. Rock Island, Ill. (Walsh).

? Cloëon Oldendorffii, Weyenbergh.

Oxycypha Oldendorffii, Weyenb., Tijdschr. v. Ent. xxvi. 1882–3, p. 173, pl. x. 6 (1883) [wing].

Imago (*living*).—Eyes dark brown; head and thorax glossy sepia-brown, the colour changing to fallow-grey on the scutellum [schildje] and passing into a greyish brown on the dorsum of the abdomen. Underside of the body of a very light colour. Setæ translucent, light grey. Legs grey. Wings vitreous, with dark neuration; the submarginal area in the figure is shaded, and two straight cross veinlets, remote from one another, are shown in the pterostigmatic space. Rudimentary intercalar veinlets of the terminal margin of the mesothoracic wing paired. No mention is made of hind wings. Length of body 5–5·5, wing 4·75, setæ 6 mm.

Hab. Cordova, Argentine Republic; in the autumn, found at rest on walls. (After Weyenbergh.)

CALLIBÆTIS, Etn., 1881.

Illustrations.—*Adult* (details), Pl. XVI. 28 *a–d*; (whole figures) see citations of Pictet (1843–5) under *C. undatus* and *C. fasciatus*. *Nymph*, Pl. XLVIII.

Adult.—Hind wing oblique, widened rapidly in front from the roots to the costal protuberance, usually rather broad, and oblong, with the tip ellipsoidally rounded off; costal protuberance large and very obtuse; neuration limited to three main longitudinal nervures, a few rudimentary intercalars from the terminal margin between the second and the third of these, and (at least in the marginal area) a considerable number of cross veinlets. Fore wing in the majority of the species variegated in one or both of the sexes in front, and sometimes in the disk; but in others without colour-ornamentation; cross veinlets numerous throughout the whole of the marginal area, and either pluriserial in the disk or arranged in a few dislocated series, as in *Baëtis*; rudimentary intercalary veinlets of the terminal margin single or paired, according to the species. Forceps-limbs of ♂ conformable to those of *Cloëon*. Penis not observed hitherto. Of the ♀ abdominal segments 6–9 are a little the longest. Caudal setæ of ♂ im. 2–2½, ♀ im. 1⅕–1½ as long as the body. Fore tarsus of ♂ about 1$\frac{1}{10}$ as long as the tibia, which is nearly 1⅓ as long as the femur; its joints in diminishing succession rank 2 subequal to 3, 4, 5, 1. Fore tarsus of ♀ about $\frac{4}{7}$ as long as the tibia, which is about as long as the femur; its joints in order of lessening length rank 2 subequal to 5, 4, 3, 1. Hind tarsus of ♂ about ½ as long as the tibia; its joints rank 1, 4, 2, 3. *Nymph.*—Abdominal tracheal branchiæ all double, with unequal divisions: the first and second are each formed of a large somewhat oblong lamina obtusely rounded at the tip, contracted transversely in some measure about midway from the roots, and slightly contorted, connate with a smaller underlying division

placed obliquely with regard to the larger; the next four are each composed of a large subovate lamina, with a flap turned over on one side close to the base, which constitutes the much smaller division; the seventh has the larger lamina narrowly ellipsoidal and a much smaller turned-over flap than the others; each of the larger laminæ is supplied with a single main trachea with long branches and short branchlets. Antennæ about as long as the head and thorax combined. Setæ subequal to one another and about $\frac{2}{3}$ as long as the body, fringed for about $\frac{8}{9}$ of their length, with the fringes gradually shortened to a point, and then tail-pointed. Mandibles terminated by slender, compressed fangs, with a tuft of hair in place of the endopodite. Palpus of maxilla I. longer than the lacinia, slender, apparently 2-jointed, with joints of very nearly equal length; lacinia armed at the tip with slender fangs, and with other slender fangs mingled with hair along the inner edge. Laciniæ of maxillæ II. obtusely falcate, rather shorter than, but nearly of equal width with, the obtusely lanceolate lobes of the labium: proximal joint of the palpus stout, compressed, narrowed slightly and evenly from the base distally; second joint about thrice as long as the third joint, slightly gibbous at the base on the inner side as far as the oblique line of muscular attachment; third joint almost as broad at the base as the end of the second joint, and subacute at the tip. Tongue somewhat similar in form to a closed ecclesiastical biretta; median lobe subrotund, bluntly mucronate, and broader than the rounded paraglossæ. Hind tarsus, claw excluded, little shorter than the tibia, which is not quite $\frac{2}{3}$ as long as the femur; the whole leg not much longer than the fore leg.

Type. *C. pictus* (in *Bœtis*), Etn.

Distribution. America from Canada to the Argentine Republic and Chili; also [undescribed sp.] Australia.

Etymology. καλός and *Bætis*, a proper name, with reference to the beauty of many of the species.

The generical identification of the nymph was ascertained by examination of the hind wings of one of the alcoholic specimens received from Dr. Hagen, subsequent to the photolithographing of Pls. XVI., XVII. It then became evident that the genus had better be ranked at the close of the section, instead of at the beginning.

CALLIBÆTIS HAGENI (renamed), Etn. MS., in the writing of Plate XVI. 28 *a* (wings and part of femur).

Bætis || *tessellata*, ! Hag., Smithson. Miscell. Coll. (1861) Synop. Neuropt. N. Am. 50; Etn., Trans. Ent. Soc. London (1871) 84 [note to *Lept. colombiæ*], and 150, note; Hag., *op. cit.* (1873) 395.

Subimago (*dried*).—Wing-membrane cinereous, or blackish grey; cross veinlets white, and narrowly bordered with white; the pale borders of a few that may happen to be close together side by side near the base or the middle of the wing are occasionally confluent, but only sparingly so; in some lights the longitudinal nervures also in great measure appear to be whitish, especially towards the terminal margin. Legs sublutescent, with the tarsi somewhat blackened. Setæ pale sepia-grey, with black joinings.

Imago (*dried*).—♀. Wings ornate; femora densely, minutely, and inconspicuously dotted; tarsi to a large extent black.—Body piceous; the dorsal sutures of the thorax

paler and yellowish; the abdomen discoloured, but rather uniformly coloured and ornamented throughout; its integument densely, minutely, and irregularly rugulose on the back, and foveolate ventrally; setæ white with black joinings (but these are reddish in imperfectly developed setæ). Wings vitreous, brilliantly iridescent; the fore wing ornamented with piceous, broadly along the costa, very narrowly along the terminal margin, and very variously in the disk; the costal markings may be described as a longitudinal stripe, deeply and irregularly eroded posteriorly, and varied diversely in different specimens with pellucid spots enclosing the cross veinlets; the terminal margin is white or pellucid at the terminations of the longitudinal nervures, but elsewhere pitch-brown, and the interneural veinlets arising from it are similarly dark, and sometimes are enveloped in little nebulæ of the same colour, or spots; the irregular spots of the disk are in connection with dark portions of the longitudinal nervures; these are mostly white, banded with piceous, only the costa, subcosta, and radius being piceous throughout; cross veinlets opaque white; the marginal area contains about 8 cross veinlets before, and 13 within the pterostigmatic space, mostly simple, though a few are forked. Femora fusco-lutescent, minutely and densely punctulate with darker, especially towards their distal extremities; tibiæ slightly paler, darkened at their distal joinings; basal joint of the tarsus almost concolorous with the tibia, but the extremity of the tibia, together with the rest of the tarsus, is dull black. Length of body, ♀ 12; wing 12; setæ about 17 mm.

Hab. Puget Sound and other parts of Washington Territory (Hag. and McLach. Mus.) and California (McLach. Mus.).

Callibætis ferrugineus, Walsh. Plate XVI. 28 *b* (wings ♀ im.).

Cloë ‡ *undata*, ! Hag., Smithson. Miscell. Coll. (1861), Synopt. Neuropt. N. Am. 53 [part].—*C. ferruginea*, Walsh, Proc. Acad. Nat. Sc. Philad. (1862), 379.—*C. fluctuans, id., loc. cit.* (1862); Hag., Proc. Ent. Soc. Philad. ii. 178 (1863).

Baëtis fluctuans, Etn., Trans. Ent. Soc. London (1871), 122.—*B.* (?) *undatus, id., op. cit.* (1871), 123 [part]; Hag., *op. cit.* (1873), 402 [part].—*B. ferrugineus*, Etn., *op. cit.* (1871), 124; Hag. & Etn., *op. cit.* (1873), 402 [part].

Subimago (*dried*).—Wing-membrane sepia- or bistre-grey; cross veinlets white, narrowly bordered with transparency in a manner very similar to those of *C. Hageni*; longitudinal neuration for the most part pale and similarly edged with transparency, the costa, subcosta, and radius of the fore wing (and, in parts, some of the other nervures) darkened uniformly with the ground-colour of the membrane. Legs sublutescent; the apical borders of the first three tarsal joints, and the extremity or sometimes the whole of the terminal joint, also the fore tibia, brown. Setæ pale sepia-grey, their joinings either opaque or blackened.

Imago (*dried*).—Wings colourless in the ♂, ornate in the ♀; femora usually quite free from dots, and then normally pale lutescent in both sexes; or in the ♂ whitish, but clouded with pale lutescent before their extremities; sometimes in the ♂ they are dotted minutely in part or throughout; tarsi of the ♂ in great measure white.—♂. Thorax normally piceous or fusco-piceous; abdomen normally with the dorsum uniformly rufo-

piceous or intense warm sepia, and the venter light reddish white, densely and rather uniformly dotted with dull dark reddish, and generally with the several pairs of subganglionic streaks well defined; but the bases of the dorsal segments above the dorsal vessel are sometimes marked each with a pale streak. Forceps-limbs white, excepting the basal joint, which is yellowish and irrorated with reddish. Setæ white, sometimes with their joinings towards their insertion opaque. Wings vitreous throughout; the marginal area of the fore wing contains about 6 faint simple cross veinlets before the bulla, and 7–12 better defined beyond it; and the intervals of these last in the pterostigmatic space are occupied by variously disposed, more or less plentiful, granulations; most of the interneural veinlets of the terminal margins are in pairs. Femora pale, somewhat lutescent, slightly darkened a little before the tip, or more nearly white, and in some specimens dotted with minute inconspicuous pale reddish specks; fore tibia usually white, with its extreme tip brown, but in one example sepia-grey with the tip piceous; fore tarsus white, sometimes with brownish ungues; hinder tibiæ and tarsi white, sometimes slightly tinged with yellowish, with the ungues, and most commonly the joinings also, light red, or piceous.

Variation, ♂ im. (*dried*).—Thorax above fuscous, varied with flavescent, and slightly dotted with darker near the insertion of the fore wings. Abdomen above closely punctulate with black, somewhat fusco-griseous, varied with reddish and greyish white; the whitish markings comprise in each segment a streak from the base of the segment along the dorsal vessel, a larger triangular spot at the base of the segment that terminates a little before its dark apical border, and another rounded impressed spot at the base of the segment, adjacent to the spiracular line, forming regular series of markings; venter whitish, tinged faintly with reddish, closely and minutely punctulate with reddish, more coarsely and sparsely punctulate with black, with a short small black acutely triangular streak at the base of each of segments 3–8, adjacent to the spiracular line, and indistinct traces of the usual series of pairs of curved linear streaks adjacent to the ganglionic cords.

♀ (*dried*).—Body variously coloured during life [ranging, according to Walsh, from whitish brown mingled with brown to pale brown with the sixth abdominal segment brown], mostly piceous afterwards; surface very similar in detail to that of the body of *C. Hageni*. Setæ white, with black joinings. Wings usually ornamented with pale piceous, in nearly the same manner as those of *C. Hageni*; but sometimes the disk of the fore wing is spotless; the costa, subcosta, and radius are whitish and translucent in the pellucid spots; there are about 6–9, mostly simple, cross veinlets before, and 12–14 beyond the bulla in the marginal area of the fore wing. Femora pale lutescent, or pale luteous; the coxæ, tibiæ, and tarsi much paler; the last tarsal joint, and the apical borders of the others, as dark as the femora, and ochreous brown. Length of body 6–9·5; wing 6–9; setæ, ♀ im. 10·5–12, ♂ 15–17 mm. (*teste* Walsh).

Hab. Widely distributed in N. America; Red River; Quesnel Lake, British Columbia; Vancouver's Island; Washington Territory; Montana; Oregon (McLach. Mus.) and The Dalles, Or. (23 June, 1882, S. Henshaw, Hag. Mus.); San José, Cal.; Colorado; Rock Island, and Normal, Ill.; also New York. Two ♂ im. from Montana have a small cloudy

fuscescent spot at the junction of the radius (3) with the subsequent two nervures of the fore wing, and in the hinder legs the ungues, the last two tarsal joints, together with the extremities of the other joints and that of the tibia, are black-brown : in one of them the 10th dorsal segment of the abdomen is pale. [Numerous specimens in Hag., and in M'Lach. Mus.]

Callibætis ——, sp. nov. ?

Imago (*dried*), ♂.—Wings ornate in this sex, as strongly and nearly in the same manner as those of *C. ferrugineus*, ♀ [compare Pl. XVI. 28 *b*]. Neuration of hind wing less sparse than in that species, closely resembling that of the hind wing of *C. montanus* [*loc. cit.* 28 *d*]. Legs much darker in colour than those of *C. ferrugineus* : the fore leg quite as dark as that of *C. Hageni*, being, in opaque view, either light pitch-brown, or warm sepia-brown, with the trochanter and base of the femur rather lighter ; hinder legs very light yellowish brown, almost whity-brown, marked in the femur with very few and very indistinct round dark dots, the tarsi dusky or corvinous, with the ungues and the terminal edges of the joints black. Abdomen intense warm sepia-brown above, inclining to pitch-brown in parts, and varied with much lighter grounding similar in tint to the predominant light yellowish-brown of the venter ; the dorsal joinings of a light colour ; the sides of the dorsum are distinctly shagreened, or impresso-punctate, with pitch-brown ; the venter is more densely impresso-punctulate with intense warm sepia-brown, and has depressions corresponding in size and situation with the pairs of abbreviated longitudinal streaks at the bases of the segments. Forceps whitish : the basal joints of the limbs uniform with the venter in colour and stippling. Setæ dusky, with black joinings. Wings vitreous ; longitudinal neuration of the fore wing fuscous, varied in places with white ; cross veinlets white, excepting sometimes a few of those contained within the dark markings adjacent to the costal margin, which markings are varied with various rounded pellucid spots in the customary manner ; the marginal area contains about 10 nearly straight, oblique cross veinlets in the pterostigmatic region, partly conjoined by a longitudinal line of irregular granulations ; the terminal margin itself is uniformly dark, and the interneural veinlets upon it are mostly in pairs. Length of body or wing 6·5–7 ; setæ 13–16 mm.

Hab. Colorado (M'Lach. Mus.). In the absence of the subimago one can hardly decide whether this should be regarded as a distinct species or not.

Callibætis pictus, Etn. Plate XVI. 28 *c* (wings and two femora).

Baëtis pictus, ! Etn., Trans. Ent. Soc. London (1871), 122. pl. v. 27 [hind wing] : Hag., *op. cit.* 1873), 402.

Callibætis [type] *pictus*, ! Etn., Ent. Mo. Mag. xvii. 196 (1881).

Subimago (*dried*).—Wing-membrane sepia-grey, transparent ; neuration (including cross veinlets) brownish, the cross veinlets sometimes narrowly and indistinctly edged with dim obscurity. Legs pale dull yellowish brown, the femora spotted, the tarsal joinings and ungues brown. Setæ sepia-grey, with dark joinings.

Imago (*dried*).—Wings colourless in ♂, ornate in ♀; femora marked with a row of 6–8 or more round spots, and with a few dots (most distinctly so in the hinder legs), sometimes confluent in part; tarsal joinings, ungues, and the last 1–3 joints blackish- or reddish-brown.—Body greatly discoloured; thorax above pitch-brown in ♂, dark lutescent in ♀; abdomen closely punctulate above, and still more so beneath; the venter and some parts of the dorsum rosy whitish-brown, with the punctulations dark red-brown; the remainder of the dorsum pitch-brown. Setæ white or reddish white, sometimes banded with grey; the joinings greyish in the ♂, black in ♀. Wings vitreous; pterostigmatic space slightly fuscescent in ♂; in ♀ the marginal and submarginal areas, and the base of the fore wing are marbled with light umber-brown somewhat faintly and more evenly than in the two preceding species, the disk and terminal margin are also irregularly clouded with faint tints of a like colour; neuration pitch-brown, the terminal margin in ♀, and nervures 1–4 in both sexes, white here and there; cross veinlets dark in ♂, white in ♀; the marginal area in ♂ has no cross veinlets before the bulla, but has 6–8 beyond it; in ♀ there are 6–9 very faint before, and 11–16 beyond it, which are mostly simple, and have no granulation interposed between them. Length of body 5–6·5; wing 5·5–7; setæ, ♂ im. about 14, ♀ about 15 mm.

Hab. Widely distributed in the southern parts of N. America; California, at Brooklyn, San José, San Raphael (31 March, Osten-Sacken), and San Gerónimo (20 April, *idem*); Texas in Bosque Co. (Belfrage); Guatemala (5000 feet); and Aceytuno (5100 feet). [Many specimens in M'Lach. Mus. and Mus. Comp. Zool. Cambridge, Mass.

A very small undescribed species of *Callibætis* (in M'Lach. Mus.) from Florida has whitish grey wings. The fore wing of the ♀ is faintly amber-tinted in the marginal and submarginal areas; but in the ♂ the membrane is devoid of ornamentation. I have seen only 7 immature examples.

Callibætis undatus, Pictet.

Cloë undata, Pict., Hist. Nat. Névropt. ii. Ephém. 264, pl. xli. 5 (1843–5); Hag., Smithson. Miscell. coll. (1861) Synop. Neuropt. N. Am. 5 [part.].

Cloëon undata, Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 575 (1853).

A Mexican species, insufficiently described, and figured questionably; but perhaps admitting of re-identification by collectors at some future time. Two kinds of *Callibætis* captured in Cuba by Poey, Gundlach, and Chas. Wright, are represented in Dr. Hagen's collection, but too imperfectly for description. Pictet alludes to a species from the same island.

Callibætis montanus, sp. nov. Etn. MS. in the writing of Plate XVI. 28 d (wings & femur).

Imago (*dried*), ♀.—Fore wings vitreous, ornamented in the marginal, submarginal, and the next adjoining areas with light raw umber-brown (fusco-luteous), the same colour extending across the base of the wing in proximity to the wing-roots, and varying in intensity distally, as well as in the proximal portion of the marginal area: neuration of a like colour, or lutescent, excepting the rudimentary cross veinlets preceding the bulla

in the marginal area, which are more or less whitish; before the bulla are 6 or 7 rudimentary cross veinlets, beyond it about 7 rudimentary and 7 well-defined simple and almost straight cross veinlets: the intercalary veinlets of the terminal margin are mostly single. Legs, in opaque view, somewhat of a dull light Vandyke-brownish grey, stippled or irrorated minutely and densely in the femora with very light burnt-umber brown; tarsal joinings also of this latter colour; terminal tarsal joints darkened; ungues black. Body discoloured; notum testaceous, irrorated on each side with brown-ochre, and traversed lengthwise by a median brown-ochreous stripe intersected by a light yellowish line. Setæ white, with the joinings and basal joints lutescent. Length of body, ♀ 6; wing 8 mm.

Hab. Central America; Aceytuno (5100 ft.) [in M'Lach. Mus.].

Callibætis fasciatus, Pictet.

Cloë fasciata, Pict., Hist. Nat. Névropt. ii. Ephém. 262, pl. xli. 4 (1843-5) [whole figure].—*C. Lorentzii*, Weyenb., Tijdsch. v. Ent. 1882–3, p. 167, pl. x. 1 (1883) [wings].

Cloëon fasciata, Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 575 (1853).

Baëtis fasciatus, Etn., Trans. Ent. Soc., London (1871) 123.

Subimago (*dried*), ♂.—Wings transparent, very light brownish- or fawn-grey, striped and spotted with light brown: fore wing mottled along the costal border, and traversed obliquely, from the costa in the neighbourhood of the bulla to the anal curve of the inner-terminal margin, by a fascia somewhat irregular in outline, but broadest and subangulated near the costa; between this fascia and the wing-roots are two large spots extending at least from the costa to the præbrachial (6) nervure, and in the disk, midway towards the wing-roots, a small spot contiguous with, or intersected by, the long intercalar nervure that follows the anal (8) nervure: along the costa beyond the fascia are a large flexuous spot, followed by a smaller straighter spot, and several other small ones, all of irregular form and apt to be more or less confluent with one another; and near the terminal margin an irregularly broken fascia extends from just below the tip of the wing almost as far backwards as the termination of the first-mentioned fascia. The markings are dark-edged throughout the wing, and in the marginal area are broken up by clear spaces bordering the cross veinlets. Legs pale dull brownish-lutescent; the fore tarsus, and the joinings and extremities of the hinder tarsi fuscous. Setæ light sepia-grey, with reddish joinings. Thorax light dull brownish-lutescent. Abdomen faded, dark above, paler beneath; each of the first six ventral segments is marked with a pair of abbreviated, longitudinal, linear, black dashes, each followed by a black dot, and also with a reddish spot at the middle of the terminal margin. [After Pictet, and a ♂ subim. in Hag. Mus.]

Imago (*living*).— ♂. Upper portion of eyes dark reddish brown. Thorax and legs grey; he former somewhat darker above, and more yellowish in colour at the sides. Abdomen bove reddish brown, sometimes nearly blood-red, or suffused with dark brown on the ack, with very dark tips to the segments; venter similar in colour to the sides of the horax. Setæ translucent, with darker joinings, especially towards the roots; the joints horter than in *C. Sellacki*. Wing-markings somewhat darker in tint than those of that

species, but of a similar colour: front margin of the fore wing mottled, in the manner prevalent in the genus, as far as the radius (3); posterior to this nervure, from the neighbourhood of the bulla of the subcosta, a curved narrow fascia extends transversely to about the anal angle; this fascia is partly confluent with an irregular blotch of moderate dimensions, seated upon the pobrachial (7) nervure and spreading on both sides to the neighbouring intercalary nervures, but not nearly to the terminal margin; the same fascia is preceded by a blotch at the wing-roots, and another smaller blotch in the vicinage of the conjunction of the sector (4) and cubitus (5), and is united to the latter by a narrow projection of the colouring along the cubitus: immediately after the fascia is a large subtriangular blotch, which extends outwards along the radius as far as the commencement of the pterostigmatic region of the wing, and transversely from the radius to the sectorial intercalar next to the cubitus; this blotch contains a clear space; a band of colouring, parallel with the terminal margin, extends from the sector (4) to the præbrachial (6), and touches the lowest extremity of the last-mentioned blotch. The rudimentary intercalar veinlets of the terminal margin of the fore wing are paired. Hind wings similar to those of *C. Sellacki*, but somewhat clouded.

♀. Eyes olive-brown. Abdomen light yellow, or at most brownish yellow. Wing-nervures brownish. [Weyenbergh; abstract translation.] Length of body 6–7; wing 5·5–9; setæ, ♀ im. from 8 to 9 mm. and upwards.

Hab. Brazil (Piet.); Cordova, Argentine Republic (Weyenbergh & Hag. Mus.). In autumn; comparatively scarce; not associated with *C. Sellacki* (Weyenb.). Dr. Hagen's specimen was no longer with me when Prof. Weyenbergh's paper arrived. This species is smaller than the following, and has the cross veinlets of the fore wing rather differently arranged (*cf.* Weyenbergh's figures).

Callibætis Sellacki, Weyenbergh.

Cloë Sellacki, Weyenb., Tijdschr. v. Ent. xxvi. 1882–3. p. 164, pl. x. 3 (1883) [wings].

Imago (*living*).— ♂. Eyes dark brown above. Thorax yellowish green, with a broad longitudinal median green stripe on the notum, which often appears sepia-colour edged with darker. Abdomen very light brown above, darker or reddish brown at the tips and in the midst of the segments, and with oblong black spots at the stigmata; venter very pale, with colourless forceps. Setæ [whitish?] annulated distinctly at the joinings with light sepia-colour towards their roots, but less distinctly so towards their extremities. Legs light brown, with the femora almost colourless above [? towards their bases]; fore legs of ♂ almost yellow. Wings ornate in both sexes: neuration light brown. The light brown markings of the fore wing are mottled, in the usual manner, with rounded clear spots enclosing single cross veinlets along the costal border, and occupy a very large proportion of the remainder of the wing posterior to the radius; they comprise a blotch at the wing-roots, nearly contiguous with another protuberance from the said border, which just overlaps the præbrachial (6) nervure, followed closely by a broad transverse fascia, nearly in the middle, which crosses the wing and terminates at the anal angle; that fascia is followed directly, at the costal border, by two abbreviated confluent bands, which by their combination compose a large irregularly triangular

blotch that encloses a clear space; another irregular band extends some distance in proximity to the terminal margin and subparallel therewith. At the terminal margin, the interneural veinlets are single. Hind wings perfectly clear.

♀. The markings of the wings correspond somewhat with those of the other sex; but the bands are more perfectly defined, though fainter in colour, and both they and the blotches are broader; hence the clear spaces are much smaller. Posteriorly the whole of the wing-membrane has a smoky tint. Eyes pearl-grey, each traversed horizontally by a black line; the remainder of the head and thorax yellow-grey, with the 'appendicular organs' almost colourless. Length of body 8–10; expanse of wings 16; length of setæ, ♂ im. 15, ♀ im. 12 mm.

Hab. Cordova, Argentine Republic; commonly, but not exclusively, in the autumn. [After Weyenbergh, abstract translation, and partly based upon his figures.]

Group III. of the Genera of the Ephemeridæ.

Adult.—At the fore-wing roots the anal (8) communicates with the pobrachial (7) nervure by a well-defined channel of circulation in the membrane; and the first axillar (9^1) nervure, detached from its own group of nervures, either meets or is very closely approximated to the anal nervure at the base of the wing. [In *Bætisca* it is subparallel with the anal, but nearer to it than to the second axillar nervure.] Legs all functional; hinder tarsi distinctly 5-jointed [the fifth joint in *Coloburus* is less distinct than is usual]; ungues rather small. Contour of ♂ oculi either evenly rounded or obsoletely ascalaphoid. *Nymph.*—the structure of the palpi varies with the Series.

First Series of Group III.

Adult.—Anal-axillar interspace [p. 81, l. 6 *from bottom*] of the fore wing curvilinear-trilateral, subtended by the outer half of the inner margin and the anal angle [in *Bætisca* closed by the terminal margin, and narrowly sublinear in form]; the intercalary nervures of this interspace, varying in number with the individual, constitute simple or divided branchlets of the anal [in *Bætisca* the second axillar (9^2)] nervure, and as a rule are entirely free from cross veinlets distinctly recognizable as such. The structure of the thoracic spiracles of many of the genera (owing to their valves being closed in the dried examples exclusively obtainable for examination) has not been ascertained in a manner sufficiently satisfactory for descriptive purposes, and is therefore taken only tacitly into account here. Pronotum of ♀, when well developed, transverse, longitudinally carinate, appressed closely to the mesonotum, and more or less broadly reflexed at the sides to a maximum not exceeding double its minimum extent. Forceps-basis of ♂, and the homologous ventral lobe of ♀, usually well developed; but the latter is small in *Siphlurus* and absent in *Oniscigaster*. Oculi of ♂ either evenly contoured or obsoletely ascalaphoid; anterior ocellus rather smaller than the others. *Subimago* quiescent many hours; its posture has been observed in only a few of the genera. *Nymph.*—Palpi of both pairs of the maxilla triarticulate. Abdominal tracheal branchiæ, when exposed, foliaceous, fringeless, and without fasciculated fibrils at the base; those

of *Bætisca* are concealed by a large notal shield when the insect becomes adolescent, and their structure is peculiar.

Section 10 *of the Genera.*—Type of *Siphlurus*. *Adult.*—In the fore wing, the first axillar nervure (9[1]) meets the inner margin at or before the middle; the anal nervure (8) terminates close to the anal angle and receives several simple or divided branchlets [intercalaries] from the outer half of the inner margin. Pronotum well developed. *Nymph.*—Palpus of maxilla 1. as long as the lacinia, or longer. Pronotum and sutures of the mesonotum well defined. Terminal margins of the fore wings free.

The affinity between the genera of this section and those of the type of *Baëtis* has already been remarked upon at page 154. *Bætisca*, ranked apart in Section 11, is rather similar to genera of the *Siphlurus* type in aspect.

The relative dimensions of legs, setæ, or segments, indicated in the definitions of the genera, are employed, in the absence of whole figures, to convey an approximately definite idea of the aspect of typical examples of the insects concerned, so far as this may be dependent largely upon those proportions. But yet the descriptions must not be interpreted rigidly in these particulars; because the generical likeness of species can be maintained and be appreciated at a glance, where the standard proportions have been departed from in some points.

Nymphs of only three of the genera of this section are known; that of *Chirotonetes* (as it is supposed) has tracheal branchiæ on segments 1–7 of the abdomen, all of which are single obovate lamellæ; *Siphlurus* has similarly situated tracheal branchiæ, but those of segments 1 and 2 are double. *Oniscigaster* has tracheal branchiæ on segments 1–6 only, of which all but the foremost are produced each on the inner side into a curiously foliated lobe.

Tabulation of the Genera of the *Siphlurus* Type.

Tibiæ of the hinder legs longer than, or at least subequal in length to, the tarsi. Proximal joint of the hind tarsus
shorter than the 2nd joint. Tarsal claws mutually
dissimilar. Costal dilatation of the hind wing acute. In ♀ abdomen the ventral lobe of segment 9 is bifid and acutely excised; pleuræ of segments 7 and 8 squarely truncate, each with a minute spinule at the point, those of segment 9 produced each into a short acute triangular tooth. Diminishing gradation of tarsal joints:—fore tarsus ♂ 2, 3, 4, 5, 1, ♀ 5, 2 subequal to 3, 4, 1; hind tarsus ♂ and ♀ 5, 2, 1 subequal to 3, 4 [in ♀ Pl. XVIII. 32 *b*, 5, 2 subequal to 3, 1, 4] ..... *Coloburus.*
alike, narrow and hooked. Costal dilatation of the hind wing obtuse. In ♀ abdomen, the ventral lobe of segment 9 is
roundly emarginate with acute points; pleuræ of segments 7 and 8 squarely truncate, of segment 9 narrowly dilated outwards and produced each into a short acute tooth behind. Gradation of tarsal joints:—fore tarsus ♂ 1, 2, 3, 4, 5, ♀ 5, 1, 2, 3, 4; hind tarsus ♂ 5, 2, 1 subequal to 3, 4, ♀ 5 ,1 subequal to 2, 3, 4..... *Chirotonetes.*
acutely excised, with short acute points; pleuræ of segments 7–9

squarely truncate. Gradation of tarsal joints:—fore tarsus ♂ 3 and 2 subequal to 4, 1, 5, ♀ subim. 2, 1, 3, 4, 5; hind tarsus ♂ 2, 5, 1, 3, 4, ♀ subim. 2, 1, 5, 3, 4. [Pl. XX. ?34*b*] ..... *Metamonius.*

subequal to the 2nd joint. Tarsal claws mutually dissimilar. Costal dilatation of the hind wing almost right-angled. In ♀ abdomen the ventral lobe of segment 9 is subtriangular with the vertex retuse; pleuræ of segments 7–9 squarely truncate. Gradation of tarsal joints:—fore tarsus ♂ 2, 3, 4, 1, 5, ♀ 2, 1, 3, 5, 4; hind tarsus ♂ and ♀ 2, 1, 5, 3, 4.—[Pl. XVIII. ?34*a*] ..... *Ameletus.*

longer than the 2nd joint. Tarsal claws mutually alike, narrow and hooked. Costal dilatation of the hind wing obtuse. ♀ unknown. Gradation of tarsal joints:—fore tarsus 1 equal to 2, 3, 4, 5; hind tarsus 1, 2, 5 subequal to 3, 4 ..... *Dipteromimus.*

Tibiæ of the hinder legs shorter than the tarsi. Proximal joint of the hind tarsus longer than the 2nd joint. Tarsal claws mutually

alike. Costal dilatation of the hind wing obtuse. In ♀ abdomen the ventral lobe of segment 9 is very short, parabolic or obtusely triangular; pleuræ of the segments 7–9 obtuse behind. Gradation of tarsal joints:—fore tarsus ♂ 2 equal to 3 and subequal to 4, 1, 5, ♀ 1, 2, 5, 3, 4; hind tarsus ♂ 1, 2, 3 subequal to 5, 4, ♀ 1, 2 subequal to 5, 3, 4..... *Siphlurus.*

dissimilar. Costal dilatation of the hind wing very small and obtuse. In ♀ abdomen the ventral segment 9 is lobeless; pleuræ of segments 1–6 truncate behind, of 3–6 slightly dilated posteriorly, those of 7–9 broadly dilated laterally and produced posteriorly each into a short acute tooth. Gradation of tarsal joints:—fore tarsus ♂ 1, 2, 3, 4, 5, ♀ 1, 2 subequal to 5, 3, 4; hind tarsus ♂ and ♀ 1, 5, 2, 3, 4 ..... *Oniscigaster.*

COLOBURUS, Etn. 1868.

Illustrations.—Adult (details) Pls. XVIII. & XIX. *a–c.*

Adult.—Fore leg of ♂ about as long as the body [when dried $1\frac{1}{10}$ as long]; tarsus about as long as the tibia, and this about $1\frac{5}{8}$ as long as the femur; diminishing sequence of tarsal joints 2, 3, 4, 5, 1, the first joint nearly $\frac{1}{8}$ as long as the second. Fore leg of the typical ♀ about $\frac{7}{11}$ as long as the body; tarsus about $\frac{3}{8}$ as long as the tibia, which is about $1\frac{1}{2}$ as long as the femur; tarsal joints in lessening length rank 5, 2 subequal to 3, 4, 1, the first joint about $\frac{1}{2}$ as long as the second. In an undescribed N. American species [Pl. XVIII. 32*b*] the ♀ tarsus is about $\frac{4}{7}$ as long as the tibia, and this about $1\frac{3}{4}$ as long as the femur. Hind tarsus of the typical ♂ about $\frac{5}{12}$ as long as the tibia, and this about $1\frac{1}{5}$ as long as the femur; the first joint is about $\frac{2}{3}$ as long as the second, but both of them are short. Ungues in every tarsus each unlike the other. Hind wings well developed, oblong-oval, with the dilatation of the marginal area acute in front, and with relatively scanty neuration in the narrow axillar region. In the ♀ abdomen the relative lengths of the 2nd–9th dorsal segments may be formulated approximately thus:—5, 8,

10, 12, 13, 13, 11, 8, 5; the first segment is thoracoid. The squarely truncate pleuræ of segments 7 and 8 are minutely mucronate; those of segment 9 are produced posteriorly each into a short acute triangular point. Forceps-basis of ♂ divided almost completely into two broad divisions; the limbs 3-jointed, the proximal joint subcylindrical, slightly enlarged or gibbous at the extreme base, and not much longer than the remaining joints combined. Ventral lobe of ♀ bifid and acutely excised. Penis-lobes narrow, obliquely pointed; orifices of the seminal ducts placed in proximity to the extreme points of the lobes; their armature is not obvious in dried specimens, but may resemble in some degree that of the penis-lobes of *Siphlurus*. Median caudal seta rudimentary, only $\frac{1}{10}$–$\frac{1}{4}$ as long as the outer setæ; these are about twice as long as the body in the ♂, and $1\frac{1}{2}$ as long as it in the ♀. Oculi of ♂ contiguous, or nearly so, above, obsoletely ascalaphoid, with the upper segments hemispherical and the lower relatively very small. Vertex of ♀ head transverse; the occipital border raised in the middle above the level of the posterior orbits of the oculi. Median ocellus smaller than the others; not isolated, but situated upon the foremost prominence of the upper surface of the head. Pronotum of ♀ broadly reflexed upon the mesopleuræ, and in the middle deeply excavated behind. *Nymph* unknown.

Type. C. humeralis (in *Palingenia*), Walker.

Distribution. New Zealand and (undescribed sp.) N. America.

Etymology. κολοβοῦρος, in allusion to the rudimentary median seta.

Coloburus humeralis, Walker. Plate XVIII. 32 *a* (wings, legs, and ♂ genitalia).

Palingenia humeralis, ! Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 552 (1853).

‡ *Baëtis remota, id., op. cit.* part iii. 564 (1853).

Coloburus [type] *humeralis*, ! Etn., Ent. Mo. Mag. v. 89 (1868); ! *id.*, Trans. Ent. Soc. London (1871), 132, pls. iii. 1 & vi. 6–6 *b* [detail].

Subimago (*dried*).—Wings very light grey, with rather darker narrow mouse-grey borders to the cross veinlets in the greater part of the disk; but in the fore wing the cross veinlets of the first three areas (excepting those of the pterostigmatic space) and also those in the first $\frac{1}{3}$ of the wing's length between the cubitus (5), præbrachial (6), and pobrachial (7) nervures are more distinctly edged with sepia-brown; the wing-roots and great cross vein, together with the bases of the principal nervures, are of a dull, very light ochreous tint; but elsewhere the neuration is dull piceous. Setæ light warm sepia- or Vandyke-brown; the joinings opaque in some examples.

Imago (*dried*).— ♂. Notum either pitch-brown or fuscous. Abdomen rufo-piceous or opaque burnt-umber. Setæ pitch-brown. Fore legs in opaque view pitch-brown; hinder femora and tibiæ in opaque view very light raw-umber- or yellowish-brown, changing in transmitted light to pale yellowish amber; hinder tarsi dull bistre-brown. Wings vitreous, tinged in proximity to the wing-roots with light raw-umber, and in the pterostigmatic region of the fore wing from the costa to the radius with light bistre-brown; neuration pitch-brown, with the roots of the longitudinal nervures light raw-umber; cross veinlets of the fore wing edged narrowly with warm sepia-brown between the cubitus (5) and pobrachial (7) nervures in the first $\frac{1}{3}$ of the wing's length, and between the costa and sector (4) in its first $\frac{1}{2}$; those of the pterostigmatic portion of the marginal area branch near the costa and mostly anastomose with one another.

♀ Very similar to the ♂. Fore leg in opaque view pitch- or dark bistre-brown, with the end of the tibia darker. Hinder legs in opaque view light bistre-brown, with tarsi of a duller colour; in one example the colour is more of a raw-umber; in transmitted light the bistre changes to light raw-umber and to brownish amber, and the raw-umber of the exceptional specimen to yellow-amber. The cross veinlets of the pterostigmatic portion of the marginal area of the fore wing branch about midway between the costa and the subcosta. Length of body 10–11 [shrunken]; wing, ♂ 13, ♀ 14–16; setæ, ♂ im. 15–20 & 2, subim. 14 & 1, ♀ im. 15 & 1, subim. 14 & 1 mm.

Hab. New Zealand; common at Christchurch (Fereday) and Otago [Brit. Mus. & McLach. Mus.].

Coloburus haleuticus, Etn. Plate XVIII. 32 *c* (penis), XIX. 32 (fore wing).

Coloburus haleuticus, ! Etn., Trans. Ent. Soc. London (1871), 133, pl. vi. 7, 7 *a* [detail].

Imago (*dried*), ♂.—Notum raw-sienna [furfurosus]. Abdomen rufo-fuscous above, rather darker at the joinings; pleuræ testaceous; venter rufo-lutescent. Setæ fuscous; forceps testaceous, tinged distally with piceous. Fore legs rufo-piceous; hinder legs light brownish ochre. Wings vitreous, with pitch-black neuration, excepting that the membrane and nervures close to the wing-roots are suffuscous, and the marginal and submarginal areas of the fore wing in the pterostigmatic region are greenish grey. Length of body, ♂ im. 11; wing 15; setæ 20 and 5 mm.

Hab. Australia; probably near Melbourne [McCoy]. Well distinguished by the shape of the penis.

CHIROTONETES, Etn. 1881.

Illustrations. *Adult* (details), Pls. XVIII. 33 *d–e* & XIX. 33 *a*, *b*, ? *c*. *Nymph*, Pl. XLIX.

Adult.—Fore leg of ♂ from about $\frac{2}{3}$ to $\frac{9}{11}$ as long as the body; tarsus scarcely longer than the tibia, which is nearly $1\frac{5}{9}$ as long as the femur; diminishing sequence of tarsal joints 1, 2, 3, 4, 5, the first nearly $1\frac{1}{6}$ as long as the second joint. Fore leg of ♀ nearly as long as the body [when dried about $\frac{8}{10}$ as long]; tarsus about $\frac{5}{8}$ as long as the tibia, and this about $1\frac{1}{2}$ as long as the femur; sequence of tarsal joints 5, 1, 2, 3, 4, the first $1\frac{1}{5}$ as long as the second. Hind tarsus of ♂ nearly $\frac{3}{4}$ as long as the tibia, and this about $\frac{5}{6}$ as long as the femur; sequence of joints ♂ 5, 2, 1 subequal to 3, 4; ♀ 5, 1 subequal to 2, 3, 4. Ungues mutually alike; those of the ♂ fore tarsus terminate each in a narrow obtuse squamiform point, creased lengthwise in the middle and concave beneath; those of the hinder tarsi and of the ♀ fore tarsus are narrow and uncinate. Hind wings well developed, obtusely oblong-ovate, with the summit of the dilatation of the marginal area obtuse; axillar region largely developed and with abundant neuration, of which a large portion is composed of numerous long branchlets of the hindermost axillar nervure. In Pl. XIX. 33 *b* the functions of the first axillar (9) have been usurped by the intercalar nervure intervening between it and the second axillar. In the ♀ abdomen the relative lengths of segments 2–10 may be formulated thus:—8, 11, 12, 12, 12, 13, 11, 11, 5; the first segment is thoracoid; the pleuræ of segments 7 and 8 are squarely truncate; those of segment 9 are very narrowly dilated laterally, and are each produced posteriorly into a short acute tooth; the ventral lobe of the 9th segment

is roundly emarginate with acute points. Forceps-basis of ♂ variously excavated or excised according to the species; forceps-limbs 3-jointed, with the proximal joint gibbous or slightly enlarged at its extreme base, and longer than the remaining joints combined. Penis of various form, without apparent stimuli. Median caudal seta sometimes totally aborted, and sometimes extremely rudimentary in the same species; outer setæ about twice as long as the body in both sexes. Oculi of ♂ obsoletely ascalaphoid, contiguous above; their inner orbits concave. Vertex of ♀ head longer than broad, very little broader in front than behind, with the occipital border only slightly raised and projected little beyond the level of the posterior orbits of the eyes. Median ocellus rather smaller than the others and isolated, occupying a small shallow depression in front of and below the anterior edge of the upper surface of the head. Pronotum of ♀ somewhat narrowly reflexed upon the mesopleuræ; its posterior margin opposite the interspace between the eyes is almost straight, but minutely emarginate in the middle, and retires to form a shallow recess thereabouts. *Nymph* [*generical identification doubtful*].—Abdominal tracheal branchiæ borne by segments 1–7, all obovate and single. Antennæ shorter than the head and pronotum, about 14-jointed at maturity. Stipes of the mandibles unusually short; endopodites absent; fangs slender, two in number. Lacinia of maxilla I. unusually short and broad, beset on the crown with numerous slender curved pectinate spines [somewhat in the same manner as that of *Thraulus* is crowned with a tuft of hair], and ciliated for some distance from the point along its inner edge; palpus equal in length to the lacinia, its first joint nearly of the same length as the second, and longer than the third joint. Laciniæ of maxillæ II. somewhat falciform, much narrower than the lobes of the labium; these are unusually broad, trilateral, with the outer side saliently rounded off and the other sides nearly straight, and are spinulose along their distal borders. Paraglossæ roundly expanded distally, and longer than the subrotund median lobe of the tongue. Abdominal pleuræ narrowly dilated, and with short acute points behind. Hind leg nearly of the same length as the fore leg; tarsus (claw excluded) about as long as the tibia. Setæ subequal in length to one another, and $\frac{1}{2}$ as long as the body; median seta plumose, the others ciliated on the inner side; their fringes taper towards the points.

Type. *Ch. ignotus* (in ‡ *Baëtis*), Walker.

Distribution. Continental Europe, in large rivers; N. America; Sumatra (undescribed sp.).

Etymology. χειροτονητής, *one that stretches out the hands*, from the attitude of the imago in repose.

Synonymous with ‡ *Baëtis* (B), Walsh, 1862, and ‖ *Isonychia*, Etn., 1871.

The nymphs referred here provisionally were sufficiently matured to show that the tarsi of the imago are 5-jointed; and so far as their wing-neuration could be ascertained, there was nothing adverse to their being placed here. Length of body 9, setæ 4·5 mm. Five specimens collected by Mr. Hubbard at Trenton Falls, N. Y., on 20th May, 1874 [the typical set], and one captured by Lieut. Carpenter near Denver and Colorado Springs in the Foot Hills, Color., in 1873 [Mus. Comp. Zool. Cambridge, Mass.], are the materials studied.

Chirotonetes ignotus, Walker. Plate XIX. 33 *b* (wings, ♂, head, and forceps).

‡ *Baëtis ignota*, ! Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 571 (1853).

‖ *Isonychia ignota*, ! Etn., Trans. Ent. Soc. London (1871), 135, pl. vi. 29.—*I. ferruginea*, ! Albarda, Ent. Mo. Mag. xv. 128 (1878); ! Etn., *op. cit.* xvi. 36 (1879).

‡ *Siphlurus, sp.* ——, ! Rostock, Jahresb. d. Ver. f. Naturk. Zwickau, 1877, p. 88 (1878).

Subimago (*living*), ♂.—Eyes subolivaceous. Wings somewhat fawn-colour, becoming (*when dried*) dull light brownish ochre or yellowish brown, bordered narrowly along the terminal margin with ivory-black grey, and marked in the anterior wing with two or three evanescent dusky nebulæ or abbreviated transverse streaks from the fore margin, due to the grouping of the cross veinlets, which are very narrowly edged with black (or *when dried* with light grey); neuration yellowish (like the membrane), with the exception of a few cross veinlets in the marginal and submarginal areas between the great cross vein and the bulla, which are black.

Imago (*living*), ♂.—Eyes light red or brownish red, with the orbits ochreous, and with a movable black round spot or curved streak. Notum pitch-brown or (*when dried*) rufo-piceous. Abdomen purple-brown above (*when dried* dull Venetian-red brown), with the joinings of the segments very narrowly brownish, the terminal segments rather paler than the others, and the edges of the pleuræ ochraceous; venter spotless, unless (as in *dried* examples) marked in segments 2–8 with a median light brownish Venetian-red triangular spot pointing forwards and extending from the hinder margin to the base of the segment, leaving on each side a pale triangular space of the lighter ground-colour. Setæ whitish, but piceous near their insertions, with this darker colour gradually shaded off. Forceps dusky, paler at their joinings. Fore leg piceous; the tibia and tarsus pitch-black, excepting the bases of the tarsal joints and the ungues, which are pale. Hinder legs lutescent straw-colour, or (*when dried*) bright amber-yellow, with the terminal tarsal joint and the outer claw dusky. Wings vitreous, with almost pellucid neuration, some of the longitudinal nervures being sometimes very faintly amber-tinted.

♀. Very similar to the ♂. Vertex of head and pronotum pale; the mesothoracic sutures in front of the wing-roots yellow-ochreous. Venter paler than in the ♂; segments 2–7 marked on each side with a black dot beside the spiracle, and each with large twin acute obtriangular light subochraceous spots enclosing a chalice-shaped or cup-like purple-brown spot in the vicinage of the ganglion (often obliterated *when dried*). Setæ ochroleucous, purple-brown at the roots. Fore tarsus dusky, with the tips of the joints black; hinder tarsi very narrowly edged at the joinings with reddish; the terminal joint and ungues dusky. Length of body or wing 12–13; setæ, ♂ im. 27, subim. 12, ♀ im. 20 mm.

Hab. Western Europe, from Holland to Southern France; Arnhem, Vasserbeck (Van Medenbach de Rooy); South Holland (Van Walcheren); Rotterdam (Fransen); Amboise (Lelièvre); Saxony (Rostock); Mariensee (5th September, M'Lach. Mus.). Also Toulouse; common at gas-lamps at the lower extremity of the Ile du Grand Ramier by the Pont suspendu de St. Michel (17–20th July); in flight after sunset near the Pont d'Empalôt (3rd September).

Chirotonetes mancus, Etn. Plate XIX. 33 *a* (wings and legs).

‖*Isonychia manca*, ! Etn., Trans. Ent. Soc. London (1871), 134, pls. iii. 4 [wing] & vi. 5, 5 *a* [detail].

Subimago (*dried*).—Wings light sepia- or Cologne-earth grey, lighter for some distance inwards from the inner margin, with narrow dark borders to most of the cross veinlets. Setæ somewhat of a dull light yellowish ochre.

Imago (*dried*).—♀. Head and notum of a colour inclining to light yellow-ochre or light Roman-ochre, modified or toned down in a slight degree with light brownish; the markings of the upper surface of the head comprise narrow piceous orbits of the ocelli; a conspicuous triangular streak or piceous spot on each side of the vertex, which extends from the base of the posterior ocellus, and in contiguity with the orbit of the oculus, nearly halfway towards the occiput; and a broad faintly defined median longitudinal brown-ochreous stripe on the vertex, intersected lengthwise by a line of the lighter ground-colour. Abdomen light rufo-piceous; venter spotless; setæ whitish yellow-ochreous, sometimes with the joinings opaque, or light reddish, towards the roots. Wings vitreous, with very light brownish neuration; in some lights the cross veinlets show out more strongly than in other lights. Fore femur in opaque view rufo-piceous; tibia less translucent than the femur, but otherwise concolorous with it; tarsus in opaque view light Vandyke-brown throughout in most of the specimens, but in some of them the first joint to a large extent is lighter and more translucent than the remainder. Hinder legs in opaque view dull greenish yellow, approaching yellow-lake, changing in transmitted light to pale yellow-amber; the ungues sometimes slightly brownish.

♂. Undescribed; the specimens of this sex referred to this species in 1871 are *Ameletus dissitus*. Length of body, ♀ im. 7–12; wing 9–13; setæ 15–22 mm.

Hab. North America; W. Texas (Belfrage) and Montana (McLach. Mus.), May to July.

Chirotonetes aridus, Say. Plate XVIII. 33 *e* (genitalia ♂).

‡*Baëtis arida*, Say, Journ. Acad. Nat. Sc. Philad. viii. 42 (1839); Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 562 (1853); Le Conte, Complete Writings of T. Say ii. 412 (1859); Hag., Smithson. Miscell. Coll. (1861) Synop. Neuropt. N. Am. 46; ! Walsh, Proc. Acad. Nat. Sc. Philad. (1862) 370; Hag., Proc. Ent. Soc. Philad. ii. 170 (1863); ! Walsh, *op. cit.* ii. 191, notes 8 & 192, note 11 (1863).

‡*Siphlurus aridus*, Etn., Trans. Ent. Soc. London (1871) 129 [after Walsh].

Subimago (after Walsh).—"Wings clouded with dusky, especially towards the tips; the hind wings broadly bordered with fuscous along the terminal margin; neuration dusky, the cross veinlets edged with fuscous. Fore legs fuscous, excepting at the base of the first and sometimes of the second tarsal joints."

Imago.—♂ (*dried*). "Head light ferruginous, with the orbit of the anterior ocellus black behind, and those of the posterior ocelli black on the inner sides. Thorax and abdomen piceous above, except the last segment; segments 2–9 occupied severally on each side by a pale ferruginous triangular or semicircular spot extending halfway from the base; venter piceous in the middle throughout its length; setæ pale greenish white; forceps sometimes fuscous towards the tips. Wings hyaline, with pale greenish hyaline

neuration, tinged sometimes with fuscous towards the costa [Walsh, 1863], or at the extreme base of the costa [*id.*, 1862]. Fore leg, as a rule, about as long as the body, variable in coloration; femur obscure greenish at the base, fuscous in its terminal half; tibia varying from a pale greenish with both its extremities obfuscated, to a uniformly dark fuscous or brown black; tarsus fuscous, with the basal halves of the joints pale. Hinder legs greenish white, with the tips of the tarsi a little cloudy. [After Walsh.]—The forceps-basis terminates distally in a shallow sinus, which leaves on each side of the distal border a short, moderately broad projection terminated by the forceps-limb. Penis-lobes obliquely acuminate.

♀. Eyes in life ferruginous, bisected by a broad yellowish band. Vertex yellow, sometimes with a yellowish vitta. Body, when different in markings from the ♂, almost uniformly ferruginous. Wing-nervures pale fuscous, excepting those meeting the inner margin of the fore wing. Fore leg entirely fuscous, excepting the basal halves of the tarsal joints, which are pale. Length of body 9–13; wing, ♂ 10·5–12, ♀ 11–15; setæ, ♂ im. 18–23, subim. 12–14, ♀ im. 17–26, subim. 10–14 mm.

Hab. North America; Rock Island, Ill. (Walsh); Washington, D.C. (Hag.); Indiana (Say), about the middle of June.

Chirotonetes intermedius, sp. nov.

Imago (*dried*), ♂.—Notum intense raw-umber brown, rather lighter in the middle in advance of the peak of the mesonotum (perhaps in consequence of pinning). Abdomen intense burnt-carmine purple, marked with yellowish white on the dorsum and venter; the dorsal markings are in segments 2–8, a large spot at the base of every segment on each side, and a very small indistinct spot or abbreviated streak in the middle of the base; the lateral spots of the dorsum increase successively in size posteriorly, those in segments 2–4 are somewhat rounded behind, and those of segments 5–8 (oblique, subtriangular and obtuse) extend from the base to about $\frac{3}{4}$ of the length of the segment, and leave in the hinder lateral angles of the dorsum triangular patches of the dark ground-colour in continuity with the colouring of the hinder border; in the corresponding ventral segments the anterior lateral angles are occupied each by a small yellowish white triangular spot; segment 10 and the forceps-limbs light dull yellowish brown, mingled with reddish purple; forceps-basis and the nearer portions of the setæ light reddish purplish, the joinings of the setæ thereabouts opaque, or burnt-carmine, the remainder of the setæ uniformly dull yellowish white. Forceps-basis similar in form to that of *Ch. siccus*; but a difference from that species is noticeable in the penis, the lobes being more rounded at the tip, and less broad, so that their form is recognizable within the gap in the forceps-basis. Fore leg about $\frac{2}{3}$ as long as the body; the femur and tibia in opaque view pitch-brown, except the inner side of the former from the base to about the middle, which is translucent light raw-umber; in oblique view the pitch-brown becomes lighter; tarsus in opaque view light brownish Indian-red, changing in oblique light almost to light burnt-sienna; in transmitted light the ungues, first tarsal joint, and the pale part of the femur are equally translucent whitish amber, the tibia and remainder of the tarsus opaque, and the femur is largely tinged with reddish purple. Hind legs in

opaque view very light yellow-ochre, with the ungues and, in a less degree, the distal edges of some of the tarsal joints light purplish brownish; in transmitted light the ochre changes to very pale amber. Wings vitreous, with bistre-, or light pitch-brown neuration; the principal nervures towards the base, and (in some lights only) the costa, subcosta, radius, and some other of the longitudinal nervures, to a larger extent paler. Length of body or wing 12, setæ upwards of 17 mm.

Hab. North America; Arizona (McLach. Mus.).

Chirotonetes siccus, Walsh. Plate XVIII. 33 *d* (genitalia ♂).

‡*Baetis sicca*, ! Walsh, Proc. Acad. Nat. Sc. Philad. (1862) 371; Hag., Proc. Ent. Soc. Philad. ii. 170 (1863); ! Walsh, *op. cit.* ii. 191–2, notes 10, 11 (1863).

‡*Siphlurus siccus*, Etn., Trans. Ent. Soc. London (1871) 130 [after Walsh].

Subimago hardly distinguishable from that of *Ch. aridus*; but in the present species the ♂ oculi are contiguous during life.

Imago.—♂. Head light ferruginous. Thorax and abdomen piceous above, spotless; setæ pale greenish white, usually with the joinings narrowly fuscous, but sometimes only so at the base; forceps a little darker towards the tips. Wings hyaline, with fuscous neuration. Fore leg usually about $\frac{2}{3}$ as long as the body, rarely as long as it, variable in coloration, commonly piceous, with the tip of the tibia and the base and tip of the 1st tarsal joint (which elsewhere is conspicuously pale) black or fuscous, and with the remainder of the tarsus entirely fuscous, excepting rarely the basal halves of joints 2 and 3, which in one example are pale. Hinder legs pale greenish, with the extreme tips of the tarsi cloudy. [After Walsh.]—Forceps-basis deeply, broadly, and somewhat squarely excised behind, in such a way that the projections terminated by the forceps-limbs are longer than broad; the margin of the basis in the middle of the excision is produced into a short subacute salient projection, which is concave beneath. Penis-lobes broad, obliquely truncate, moderately acute at their outer distal angles.

♀. Very similar to the ♂. Fore tarsus pale fuscous, with the first joint conspicuously pale. Length of body 8·5–11·5; wing, ♂ 9–11·5, ♀ 11–13; setæ, ♂ im. 19, ♀ im. 15 mm.

Hab. North America; Rock Island, Ill. (Walsh), appearing a month later than *Ch. aridus*. Also North Carolina (McLach. Mus.).

Chirotonetes (?) ornatus, Etn. MS., in the writing of Plate XIX. 33 ? *c* (genitalia ♂).

This species must be dealt with and described in the Supplement as one of undetermined genus. My discrimination of generical differences in the present Section (the type of *Siphlurus*) has been matured very recently; whereas the drawings and description of the insect were made in the year 1876, and I have not subsequently seen a specimen. The plate was lithographed in 1882.

METAMONIUS, gen. nov.

Illustrations. Adult (details), Pl. XX. ? 34 *b*.

Adult.—Fore leg of ♂ about $1\frac{1}{3}$ as long as the body; tarsus a little more than twice

as long as the tibia, and this nearly $1\frac{1}{8}$ as long as the femur; gradation of tarsal joints in order of diminution 3 and 2 each subequal to 4, 1, 5; the first scarcely more than $\frac{1}{2}$ as long as the second joint. Hind tarsus about $\frac{3}{4}$ as long as the tibia, and this subequal in length to the femur; sequence of ♂ tarsal joints 2, 5, 1, 3, 4: the first joint $\frac{4}{5}$ as long as the second. Ungues mutually alike in every tarsus, narrow and uncinate. Hind wings well developed, ovate-trilateral; the dilatation of the marginal area moderately obtuse in front; the axillar region narrow, and with scanty neuration. In the ♀ subimago the relative lengths of the abdominal segments counting from the 2nd to the 10th may be formulated thus:—5, 12, 12, 12, 15, 17, 11·5, 11·5, 9; segment 1 is thoracoid. The pleuræ of segments 7–9 are squarely truncate [7 appears to be branchiate in the nymph]; the ventral lobe of segment 9, acutely excised, has short acute points. Forceps basis of ♂ angularly and widely emarginate; forceps-limbs, as in *Siphlurus*, 4-jointed, with a short basal joint tuberculate on the inner side distally, and with a curved subcylindrical second joint longer than the remainder. Penis-lobes narrow, somewhat like those of *Siphlurus*. Median caudal seta rudimentary, about $\frac{1}{8}$ as long as the others, which in ♂ are about $1\frac{1}{2}$ as long as the body. Oculi apparently ascalaphoid, and contiguous above in the ♂; anterior ocellus rather smaller than the others. *Nymph* unknown.

Type. *M. anceps*, sp. nov. (in ? *Siphlurus*, Etn. MS. 1883, in writing of Pl. XX.).

Distribution. S. America.

Etymology. μεταμώνιος, borne by the wind.

Metamonius anceps, sp. nov.

Siphlurus (?) *anceps*, ! Etn. MS., in the writing of Pl. XX. 34 *b* (wings & legs).

Subimago (*dried*).—Wings light sepia-grey, with piceous or pitch-brown neuration; in some lights only, the longitudinal nervures appear light warm sepia-brown, and the cross veinlets black; cross veinlets narrowly edged with darker grey. Setæ sepia-grey, with dark joinings.

Imago (*dried*), ♂.—Notum brown-ochreous. Abdomen in opaque view either light raw-umber, or else reddish brown; segments 3–8 paler on each side from the base nearly to the terminal border; in some examples the pale spaces in segments 3–6 are each obtusely triangular and translucent, and a dark triangle of the ground-colour occupies the hinder lateral angle below the space [but the pallor of these species may be partly due to *Psocidæ*], and the corresponding spaces in segments 7 and 8 are very pale yellowish ochre. Venter bordered laterally with very pale yellowish ochre, leaving in the midst a broad longitudinal dark burnt-umber or purplish brown stripe. Setæ warm sepia-grey, with opaque joinings. Legs, in opaque view, light raw-umber; the knee and tip of the tibia of the fore leg, and the knees and tarsal joinings of the hinder legs dark raw-umber or bistre-brown. Wings vitreous, with the pterostigmatic region of the fore wing almost imperceptibly dusky; neuration pitch-black, the cross veinlets in the pterostigmatic portion of the marginal area of the fore wing sparingly conjoined near the costa. Length of body 10–13; wing, ♂ 13–14, ♀ 17; setæ, ♂ im. 17 & 2, subim. 10 & 2 mm.

Hab. Chili (Reed, in M'Lach. Mus.). The adult ♀ is not represented.

AMELETUS, gen. nov.

Illustrations. Adult (details), Pl. XVIII. ? 34 *a* and LXIV. 22–24.

Adult.—Fore leg of ♂ as long as the body; tarsus nearly $1\frac{5}{6}$ as long as the tibia, and this nearly $\frac{9}{10}$ as long as the femur; the joints in diminution rank 2, 3, 4, 1, 5, and the first is about $\frac{1}{2}$ as long as the second joint. Fore leg of ♀ between $\frac{1}{2}$ and $\frac{2}{3}$ as long as the body; tarsus very nearly of equal length with the tibia, which is about $\frac{9}{10}$ as long as the femur; the joints in decreasing length rank 2, 1, 3, 5, 4, and the first is very nearly $\frac{6}{7}$ as long as the second joint. Ungues mutually dissimilar in each tarsus. Hind wings well developed; dilatation of the marginal area angular in front; axillar region moderately narrow, and with rather scanty neuration. In the ♀ abdomen the segments are proportioned somewhat as in *Chirotonetes*; the first is thoracoid. Pleuræ squarely truncate in segments 7–9; ventral lobe of the ninth segment subtriangular, with the apex retuse. Forceps-basis of ♂ widely and angularly excised; its posterior corners by the inner sides of the proximal joints of the limbs are shortly produced; the limbs are 4-jointed, with a short basal joint tumid interiorly, and with the next joint, longer than the remainder, slightly gibbous on the inner side at the base. Penis-lobes narrow, with terminal superior stimuli, as in *Siphlurus*. Median caudal seta completely aborted; outer setæ about as long as the body in both sexes. Oculi of ♂ obsoletely ascalaphoid, contiguous with each other above. Vertex of ♀ head a little longer than broad, distinctly wider in front than behind; occipital margin level with the posterior orbits of the eyes. Median ocellus of ♀ much smaller than the others, isolated in a small deep depression in advance of and below the anterior edge of the upper surface of the head. Pronotum of ♀ broadly reflexed upon the meso-pleuræ; its posterior margin (viewed from above) somewhat evenly arched and not receding in a very marked degree in the middle.

Nymph unknown.

Type. A. subnotatus, sp. nov.

Distribution. N. America.

Etymology. ἀμέλητος, neglected, or overlooked.

AMELETUS DISSITUS, sp. nov. Plate LXIV. 22 (forceps-basis).

‖ *Isonychia* ‡ *manca* ♂ im., ! Etn., Trans. Ent. Soc. London (1871) 134, pl. vi. 5 [excl. ♀] (genitalia *misdrawn*).

Imago (*dried*), ♂.—Predominant colour of the body bright brown-ochre (perhaps ferruginous in life); pronotum piceous; metanotum piceous behind; dorsal segments 2–8 of the abdomen bordered distally with pitch-brown, each with extensions of the same colouring forwards at the sides in the form of triangular spots, which, at least in segments 6–8, occupy the hinder lateral angles of the dorsum and extend to the base of the segment; the ninth segment has corresponding streaks from the hind border. Ventral segments rather lighter than the dorsum, and seemingly marked each with a light pitch-brown blotch at the base in the middle: forceps-basis, posterior to the oval depression, light yellowish; forceps-limbs piceous. Setæ medium warm sepia-brown

with opaque joinings. Fore leg, in opaque view, pitch-brown; hinder legs in some lights bronze-brown, in other lights dull yellowish with the femora tinged with bistre-brown, and in transmitted light brownish yellow. Wings vitreous, very faintly tinted with greenish grey; neuration piceous. Length of body or wing, ♂ 10–12·5; setæ, ♂ im. 17–18 mm.

Hab. North America; California (Edwards; M'Lach. Mus.); San Geronimo, Cal., April 20 (Osten-Sacken; Mus. Comp. Zool. Cambridge, Mass.).

Ameletus subnotatus, sp. nov. Plate XVIII. ? 34 *a'* (legs) and LXIV. 23 (forceps-basis).

Siphlurus? ‡*femoratus*, ! Etn. MS., in the writing of Pl. XVIII. *loc. cit.*

Subimago (*dried*), ♂.—Wings light sepia-grey with pitch-brown neuration, the latter colour varying with change of light to bistre-brown; cross veinlets margined with sepia-brown. Setæ warm sepia-brown, with opaque joinings.

Imago (*dried*).— ♂. Body pitch-brown; metanotum pitch-black; the dorsal segments of the abdomen appear to be largely occupied with pale light brownish yellow subtriangular blotches, one on each side in segments 2–7, which leave in each of them the terminal border, a median longitudinal stripe, and a triangle that extends along the pleura from the hinder lateral angle to the base, of the dark ground-colour; pleuræ narrowly concolorous with the venter, which is rather paler than the light dorsal blotches, and is marked in segments 2–6 with two short dark dashes from the base of the segment, and a dark dot on each side of the median tract nearly midway between the base and tip; the ninth ventral segment, of a light brown-ochreous tint, has indications of two corresponding dark streaks at the base in the form of triangular spots, and is bordered laterally with pitch-brown as far as the joining of the forceps-basis; the depressions of the forceps-basis are shaded with bistre-brown; forceps-limbs light bistre-brown. Setæ raw-umber brown at the base, lighter distally. Fore leg in opaque view dark rufo-piceous, banded with pitch-black before the knee, the general colour changing in other lights to dark bistre-brown. Hinder legs in opaque view light bistre-brown, varying towards light raw-umber with change of posture; femora banded with pitch-brown before the knee; tarsi browner than the tibiæ in certain lights, especially the terminal joint and ungues. Wings vitreous; the fore wings close to the wing-roots, and the hind wings to a slightly larger extent at the base, clouded with intense bistre- or pitch-brown; longitudinal neuration, in opaque view light pitch-brown, in oblique view light raw-umber (excepting the stem of the præbrachial, which in most postures remains pitch-brown) and in transmitted light translucent piceous; cross veinlets in opaque view intense pitch-brown, bordered narrowly with pitch- or bistre-brown, which bordering gives rise to small specks in the fore wing, viz.:—one near the bulla of the radius (3), one at the proximal extremities of each of the two pairs of shorter sectorial intercalary nervures, one at the fork of the præbrachial (6), and another near the proximal termination of the intercalary nervure contained within that fork: the pterostigmatic portion of the marginal area contains about 17 branched cross veinlets (counted at the subcosta), which, mutually anastomosing, form a rather dense reticulation, preceded towards the bulla by about 5 more distant simple cross veinlets.

♀. Wings free from the basal discoloration, and nearly so from the specks noted in ♂, but yet with dark-bordered cross veinlets. Fore leg in opaque view pitch-brown, in some lights intense bistre-brown, paler at the base and at the knee, but not dark-banded. Hinder femora raw-umber brown, with a single ill-defined dark band before the knee. Setæ light Cologne-earth brown, with the joinings and bases of an intense shade of the same colour or piceous. Abdomen discoloured: the median dorsal stripe apparently is represented by a longitudinal line on each side of the track of the dorsal vessel, and the lighter blotches seem to be less conspicuous than in the ♂: instead of the ventral dashes and dots of the other sex, the ♀ has only small conspicuous twin oval dark-edged spots in the places of the ganglia. Length of body 11–12; wing, ♂ 13, ♀ 14; setæ, ♂ im. about 17, ♀ im. 13 mm.

Hab. Colorado (M'Lach. Mus.).

Ameletus exquisitus, sp. nov. Plate LXIV. 24 (forceps-basis).

Imago (*dried*), ♂.—Mesonotum brown-ochreous; metanotum pitch-brown. Abdomen in segments 2–6, and sometimes in a large part of 7, translucent at the sides: the dorsum in these segments, in a large measure tinged with a rich brown-ochre, is bordered along the terminal margin with light pitch- or with Vandyke-brown, this darker colour occupying the hinder lateral angles of the segments so as to form a series of right-angled triangular spots extending each from the hind margin of the segment to the point of origin of the segmental tracheæ; the tracheæ themselves are slightly brownish; again from the dark terminal border in every segment two slender streaks issue basewards, one on each side of the median track, which in ill-marked specimens are represented by small triangular spots only, at the border in question. The remaining dorsal segments are more opaque than the preceding, but are marked in a nearly corresponding manner with the same darker colour, excepting the terminal segment, which is almost uniformly of the lighter colour. Venter in segments 2–6 translucent, and (like the translucent portions of the dorsum) of a somewhat light bistre-grey colour; in segments 7–9 very light brownish ochre; the ganglia brownish, and the forceps-basis tinged at the lateral borders with bistre-brown. Forceps-limbs pitch-brown. Setæ warm sepia-brown, dark at the joinings throughout, and also dark near the roots. Fore leg in opaque view pitch-brown, with the knee yellowish brown. Hinder femora bistre-brown in opaque view, with a dark præapical band; the tibiæ and tarsi in opaque view light bistre- or raw-umber brown, with the ungues opaque, or sometimes the tarsi are sepia-brown; in transmitted light the tibiæ and tarsi acquire a yellowish tint, seldom approaching brownish or dark yellowish umber. Wings vitreous, tinted almost imperceptibly with bistre-grey throughout; the pterostigmatic portion of the fore wing transparent bistre-brown: neuration in opaque view dark bistre-brown, in oblique view almost raw-umber, but somewhat of a redder brown; in transmitted light translucent rufo-piceous; cross veinlets of the pterostigmatic portion of the marginal area of the fore wing branched evenly near the costa, and regularly anastomosing with one another. Length of body, ♂ im. 14, wing 16: setæ defective.

One specimen, perhaps a dwarf of the same species, measures :—length of body, ♂ im. 8, wing 10 mm.

Hab. North America ; larger examples Washington Territory ; smaller example Mt. Hood (McLach. Mus.).

DIPTEROMIMUS, McLach. 1875.

Illustrations. Adult (details), Pls. XX. 35 [N.B.—The hind wing is defective] & LXIV. 25.

Adult.—Fore leg of ♂ about $1\frac{1}{7}$ as long as the body ; tarsus twice as long as the tibia, and this about $\frac{8}{9}$ as long as the femur ; decreasing sequence of tarsal joints, 1 equal to 2, 3, 4, 5. Hind tarsus about $\frac{7}{9}$ as long as the tibia, which is $\frac{9}{10}$ as long as the femur ; its joints rank 1, 2, 5 subequal to 3, 4, and the first joint is about $1\frac{1}{2}$ as long as the second. Ungues all narrow and uncinate. Fore wing unusually narrow and long in its proportions, rapidly narrowed to the roots in its proximal $\frac{1}{3}$, and elliptical beyond that. Hind wings very rudimentary, trilateral and elongate, with the marginal area obtusely rounded off in front. ♀ unknown. Forceps-basis shallowly, widely, and angularly excised ; forceps-limbs 4-jointed, the basal joint very short resembling a gibbous enlargement of the second, which is longer than the remainder, curved, and bordered on its inner side with a narrow membranous expansion. Penis-lobes narrow, unarmed. Median caudal seta aborted in two specimens, but present in another and then (so far as as can be inferred from the remnant preserved) at least half as long as the outer setæ ; these are minutely pubescent, and are upwards of twice as long as the body. Oculi of ♂ obsoletely ascalaphoid, probably contiguous above during life ; anterior ocellus rather smaller than the others.

Nymph unknown.

Type. D. tipuliformis, McLach.

Distribution. Japan.

Etymology. δίς, πτερόν, and μῖμος, from its similarity in aspect to a *Tipula*.

Dipteromimus tipuliformis, McLach. Plates XX. 35 (wings, legs, and genitalia ♂,) & LXIV. 25 (hind wing refigured).

Dipteromimus tipuliformis,! McLach., Trans. Ent. Soc. London (1875), 170.

Imago (*dried*), ♂.—Pronotum, hinder parts of the mesonotum, metanotum, and the thickened hind border of the first abdominal segment yellow ochreous ; the anterior parts of the mesonotum either raw-umber or pale reddish brown. Abdomen in segments 1-6 translucent, the dorsum bistre- or light greenish grey, passing into brownish ochre posteriorly in segments 6–9, and marked on each side in segments 2–7 with angulated piceous stripes ; the foremost stripe lies wholly on the dorsum in segments 1 and 2, the portion in the first segment meeting that in the second segment a little above the hinder lateral angle of the former segment at a very obtuse angle ; the other stripes lie partly along the pleura in one segment and partly in the dorsum of the next segment, in this manner :—the portion in the anterior segment commences at the anterior lateral

angle of the ventral arcus, is very narrow, and terminates in the hinder lateral angle of the dorsum of the same segment, where it is met by a much broader stripe, which, for a short space, follows the terminal border or joining upwards, and then is suddenly diverted into the next segment, through which it passes obliquely, and subparallel with the lower moiety of the next stripe, to the terminal border of that segment; in segments 5–7 the borders of the dorsal vessel are perhaps faintly darkened, and there may be a fine indistinct longitudinal streak from the base on each side of it, such as is common in the Ephemeridæ; segment 10 is yellow-ochreous. Venter in the translucent segments pale yellowish horn-colour; in the opaque segments extremely pale yellowish ochre; perhaps free from markings, excepting the streaks, already referred to, by the pleuræ. Forceps-limbs reddish brown. Setæ pitch-, or intense burnt-umber brown. Wings vitreous, almost imperceptibly tinted with bistre-grey; neuration in opaque view for the most part pitch-black; the costa, subcosta, and the intervening cross veinlets of the fore wing pitch-, modified with madder-brown; the finer longitudinal nervures pale near the wing-roots, and the stronger nervures raw-umber brown thereabouts; in transmitted light the neuration as a whole becomes pitch-brown. Fore leg in opaque view raw-umber brown; the femur lighter than the remainder, excepting just at the knee. Hinder femora, in opaque view, very light raw-umber, with the knee pitch-brown; tibiæ and tarsi darker than the femora and of a yellower tint that approaches brown-ochre. Length of body 11–14; wing, ♂ 13–16; outer setæ (of the larger example) upwards of 24 mm.

Hab. Japan (Von Siebold, Leyden Mus.); Yamato, 16th June, and Tokio, 27th Sept. (G. Lewis, McLach. Mus.).

SIPHLURUS, Etn. 1868.

Illustrations. Adult (details), Pl. XX. 34 *c–e* [*excl.* XVIII.? 34 *a*, & XX.? 34 *b*]; (whole figure) see citation under *S. flavidus* [‡ *Baëtis*], Ed. Piet. (1865). *Nymph.* Pl. L.; also poorly represented in Rösel, Insect. Belust. ii. pl. xii. 4–6 (1749), and De Geer, Mém. Sav. Etr. Acad. Paris, ii. 468, pl. xvii. 1 (1755).

Adult.—In normal species the fore leg of ♂ the is usually nearly ($\frac{11}{12}$) as long as the body; tarsus about $2\frac{7}{11}$ as long as the tibia, and this $\frac{11}{14}$ as long as the femur; decreasing gradation of the tarsal joints,—2 equal to 3 and subequal to 4, 1, 5; the first joint $\frac{7}{9}$ as long as the second. Fore leg of ♀ $\frac{3}{3}$ as long as the body; tarsus very nearly $1\frac{1}{2}$ as long as the tibia, and this almost $\frac{7}{10}$ as long as the femur; its joints in diminishing sequence rank 1, 2, 5, 3, 4, and the first is about $1\frac{3}{7}$ as long as the second joint. Hind tarsus of ♂ $1\frac{1}{2}$ as long as the tibia, and this about $\frac{3}{5}$ as long as the femur; its joints rank 1, 2, 3 subequal to 5, 4, and the first is about $1\frac{7}{8}$ as long as the second joint. Ungues all narrow and uncinate. Hind wings well developed, obtusely ovate-trilateral; dilatation of the marginal area obtusely rounded in front; axillar region somewhat ample and well supplied with neuration. In the ♀ abdomen the relative lengths of segments 2–10 may be formulated thus:—5, 9, 10, 12, 12, 15, 17, 15, 9; the first is thoracoid. Pleuræ in segments 7–9 obtuse behind; ventral lobe of segment 9 very short, parabolic or obtusely

triangular. Forceps-basis entire, or only slightly retuse, produced shortly between the bases of the limbs and there split along the sides to admit the edges of their proximal joints when the forceps close. Forceps-limbs 4-jointed; 1st joint short, slightly compressed, broader than the second, and forming a prominent projection inwards; 2nd joint the longest. Penis-lobes narrow and shortly beaked; the orifice of the seminal duct on the inner side of the beak is immediately interposed between the point of the lobe and a small moveable appendage [stimulus], which together form the beak. Median seta aborted; lateral setæ of ♂ about $1\frac{3}{5}$, of ♀ about $1\frac{1}{2}$ as long as the body. Oculi of ♂ obsoletely ascalaphoid, contiguous above during life. Vertex of ♀ head about as broad as long, very little wider in front than behind; the occipital border almost level with the posterior orbits of the oculi. Median ocellus of ♀ much smaller than the others, isolated in a small deep depression in front of and below the anterior edge of the upper surface of the head. Pronotum of ♀ broadly reflexed upon the mesopleuræ, and with a shallow curved median recess behind, which is not always distinguishable as a recess when viewed from in front.

A long-legged species in N. America [*S. typicus*] has the fore leg of the ♂ about $1\frac{1}{2}$ as long as the body; tarsus about thrice as long as the tibia, and this $\frac{12}{13}$ as long as the femur; tarsal joints (as, *a priori*, probable in so attenuated a tarsus) slightly inconstant in their relative lengths, but the first joint is equal in length to the second. Fore leg of ♀ about $\frac{10}{11}$ as long as the body; tarsus about $1\frac{3}{5}$ as long as the tibia, and this $\frac{7}{9}$ as long as the femur; the proportions of the first tarsal joint to the second are as 17 to 13. Hind tarsus of ♂ about $1\frac{2}{5}$ as long as the tibia, and this about $\frac{5}{6}$ as long as the femur; its joints rank in lessening length 1, 2 subequal to 5, 3, 4, and the first is about $1\frac{1}{7}$ as long as the second joint. Median seta aborted; outer setæ in ♂ nearly twice as long as the body; in ♀ about $1\frac{2}{3}$ as long as the same. In other particulars this species is normal.

During repose the *subimago* stands upon all of its feet, with the wings erect and setæ divergent.

Nymph.—Very similar to *Cloëon*, but readily distinguished therefrom by having only the foremost two tracheal branchiæ on each side double, and by the endopodites appended to the mandibles.—Abdominal tracheal branchiæ foliaceous and diversiform, borne by segments 1–7 and inserted each in a notch, close to the projection of the pleura, in the posterior margin of the dorsum; those of the first two segments formed each of two laminæ narrowly connate at the base, the others of single laminæ; their tracheæ multipartite, except sometimes those of the hindermost. In nymphs of advanced grade the venation, so to speak, of these organs is a useful aid to the discrimination of species; the figures in Pl. L. illustrate sufficiently the kind of differences noticeable. Antennæ at maturity about 14-jointed, not longer than the head and pronotum combined. Mandibular lobes strong and fang-like; the endopodite well developed; stipes well-proportioned. Palpus of maxilla 1. longer than the lacinia. finger-like [in fig. 1 the articular membrane of the proximal joining is shown as if distended by glycerine]; the first joint a little longer than the second and longer than the third, the extremity of which is acute; lacinia narrow, oblique at the point, crowned with a tuft of hair and

beset with ciliæ intermingled sparsely with spines for some distance from the point along its inner edge, and with a small tuft of hair immediately below; the spines are not symmetrical in both maxillæ of the first pair. Laciniæ of maxillæ II. nearly of equal breadth with the lobes of the labium, which nearly conform to quadrants of a circle; proximal joint of the palpus compressed and somewhat dilated inside before its extremity; second joint slightly curved towards the base, enlarged distally and obliquely truncate, equal in length to the third and half as long as the first joint; third joint acutely subovate. Paraglossæ rounded distally, narrower and shorter than the median lobe of the tongue, which is widely retuse at the tip. Hind leg rather longer than the fore leg; tarsus (claw excluded) about as long as the tibia. Dorsum smooth; pleuræ of the intermediate abdominal segments narrowly dilated oniscoidally, their outer edges nearly straight for some distance from their points, and gently receding in a convex curve anteriorly. Setæ subequal in length; the median plumose; the outer ciliated inside and approximately $\frac{6}{11}$ as long as the body; in some species the fringes are conterminous with the setæ, in others these are tail-pointed.

Type. *S. flavidus* (in ‡*Baëtis*), Ed. Pictet.

Distribution. Europe, N. America, and Japan, in streams, rivers, and lakes; species more numerous in America, Northern Europe, and in mountainous regions than elsewhere.

Etymology. σιφλός, defective, and οὐρά, tail, from the atrophied condition of the median caudal seta.

Subsequent to De Geer, no author appears to have noticed the nymph of *Siphlurus* for upwards of a century. Dr. Hagen met with it in Prussia, but did not identify the species or genus. The generical determination of the nymph was accomplished by observation of *S. lacustris* in North Wales at the lakelet on Snowdon in the year 1868.

EUROPEAN SPECIES.

SIPHLURUS FLAVIDUS, Ed. Pictet.

‡*Baëtis flavida*, ! Ed. Piet., Synop. Névropt. d'Esp. 24, pl. iii. 1–6 (1865).

Siphlurus [type] *flavidus*, ! Etn., Trans. Ent. Soc. London (1871), 125, pl. v. 30 [detail after Piet.].

Imago (*dried*).—♂. Notum and abdomen somewhat brown-ochreous, the latter with longitudinal fuscous [brunes] markings on the hinder segments; the venter is marked with a series of strongly curved horseshoe-like or U-shaped lines pointing forwards. Setæ brown-ochraceous, with fuscous joinings. Wings vitreous, with a general faint yellowish tint, and a well-pronounced yellowish stain at the base and in the pterostigmatic portion of the fore wing. Legs yellowish ochre, with fuscous joinings.

♀. Very similar, but paler. Length of body 12; wing, ♂ 12·5, ♀ 14·5 mm.

Hab. San Ildefonso, Segovia, Spain, in July (chiefly after Ed. Pictet).

SIPHLURUS ARMATUS, Etn. Plate XX. 34*e* (forceps).

Siphlurus armatus, ! Etn., Trans. Ent. Soc. London (1870) 6; ! *id., op. cit.* (1871) 126, pl. vi. 1, 1*a* [detail].

Imago (*dried*), ♂.—Thorax luteo-piceous above. Abdomen fuscous above, with the joinings paler towards the sides; venter lutescent or ochraceous, with U-shaped dark marks in the hinder segments. Forceps piceous. Setæ either of the very lightest warm sepia-grey, or faintly tinged with fulvous; the joinings fuscous. Fore legs piceous; hinder legs lutescent or ochraceous. Wings vitreous tinted with greenish grey; their neuration piceous. Length of body 14–15; wing 15–16; setæ, ♂ im. 24–25 mm.

Hab. England and Ireland: Killarney (M'Lach. Mus.); Bishop's Wood, Hampstead, Middlesex (Wormald), in July.

SIPHLURUS LACUSTRIS, Etn. Plate XX. 34*d* (head ♂, legs, and forceps).

Siphlurus lacustris, ! Etn., Trans. Ent. Soc. London (1870), 7; ! *id.*, *op. cit.* (1871), 126, pl. vi. 2 [detail].

Subimago (*living*).—Wings cinereous or very light sepia-grey.

Imago (*living*), ♂.—Eyes dark sepia-brown above, dark greenish grey beneath. Thorax jet-black above, pitch-brown when dried. Abdomen piceo-fuscous above, with ochraceous joinings; venter dark greenish-grey, becoming fulvescent in the last three segments, which are marked each with a dark U-shaped streak, represented in every anterior segment by two dark longitudinal stripes, convergent towards the base of the segment. In dried examples of what I suppose to be the same species the venter becomes yellowish brown, with pale joinings, and the dark markings are sometimes absent. Forceps-limbs bistre-brown. Setæ sepia-brown at the base and greenish grey elsewhere, with opaque joinings; when dried light burnt-umber brown. Legs yellowish brown in dried examples; in life the fore femur is black-green, the tibia and tarsus greyish black, and the hinder legs are dark greenish grey. Wings vitreous, with piceous neuration; the pterostigmatic region of the fore wing is faintly tinted with pale greenish.

♀. Similar, but with sepia-brown setæ, and with the hinder tibiæ and tarsi light brown-ochraceous. Length of body or wing 12–15; setæ, ♀ im. 17–20, subim. 11; ♀ im. 16–18 mm.

Hab. Great Britain: Llyn Llydaw, Snowdon; streamlets or small burns in the neighbourhood of Corse, near Lumphanan, Aberdeenshire; in August. Also the Giffre, near Samoëns, Savoie (2280 ft.), in September; also near San Marcello in the Apennino Pistojese (about 2500 ft.) in August.

SIPHLURUS LINNÆANUS, Etn.

Siphlurus Linnæanus, ! Etn., Trans. Ent. Soc. London (1871), 127, pl. vi. 3, 3*a* [detail].

Imago (*dried*), ♂.—Thorax above bistre-brown in front, varied with light reddish ochre behind. Abdomen along the middle of the back broadly fuscous, darker at the tips of the segments, light ochraceous at the sides, the dark colour extending forwards at the sides in segments 2–9 so as to restrict the paler colour to a triangular patch above the spiracular line; venter in segments 2–8 light ochraceous marked with black, viz.:—with the joinings of segments 2 and 3, and in each of segments 2–8 a short triangular streak from the middle of the base, pointing backwards, followed by a transversely placed pair

of dots, and flanked in segment 8 by a longitudinally elongate spot, in segments 7–4 by an obliquely elongate spot, and in segments 3–2 by an oblique linear stripe from the posterior angle to the base, on each side; segment 9 and the forceps-basis red-brown. Setæ whitish brown-ochre, with the joinings intense sepia-brown. Fore tibia and tarsus dark reddish brown, the femur lighter, banded before the tip with dark reddish brown; hinder legs light brown-ochraceous, the femora with dark median bands. Wing vitreous, perhaps suffused with a faint bistre-grey tint (but this appearance may be due to the overgrowth of mould); longitudinal neuration pitch-black, the nervures towards the base of the wing becoming somewhat of a bistre-brown; the cross veinlets in the pterostigmatic portion of the fore wing simple. Length of body, ♂ 13; wing 14; setæ 26 mm.

Hab. Unknown. (Linn. Mus.) This may be an American species; but there is one rather like it in the Italian Alps, in the neighbourhood of Monte Adamello.

I have seen several other European species of *Siphlurus*.

NORTH-AMERICAN SPECIES.

SIPHLURUS OCCIDENTALIS (renamed). Plate LXIV. 26 (forceps-basis).

‡ *Heptagenia* ‡ *brunnea*, ! Hag., Ann. Rep. U. S. Geol. & Geograph. Survey of the Terr. 1873, part iii. Zool. 581 (1875) [♀ im. only].

Subimago (*dried*).—Wings very light sepia-grey, with pitch- or dull raw-umber brown neuration; longitudinal nervures pale at the base. Setæ pitch-brown with opaque joinings.

Imago (*dried*).— ♂. Notum pitch-brown, sometimes almost rufo-piceous along the median suture of the mesonotum. Dorsum of the abdomen bistre-brown, varied with dull light ochraceous, nearly in the same manner as in *S. typicus*; in segments 2–9 two tapering streaks are projected from the darker colouring into the paler space on each side of the segment; the lower streak extends along the lateral border of the dorsum to the base of the segment, and the upper streak, higher up on the side of the back, running nearly horizontally, also attains the base; the lighter ground-colour adjoining the dark streaks remains in the form either of a pair of unequal triangular spots or longitudinal streaks on each side of the base of the segment, of which the lower streak is the larger, or in the form of a single triangular spot corresponding with the lower of the two. Venter very light brown-ochraceous with piceous markings, viz.:—in segment 9 a pair of broad stripes, each tapering to a point behind, which meet in the middle of the base of the segment at an acute angle, so as to form a V; in segments 8–5 the corresponding stripes combine at the base so as to form U-shaped marks with oblique-pointed arms; in the more anterior segments their likeness to the letter U diminishes, owing to increased obliquity in the stripes and consequent increase of width in the curves resulting from their combination. The usual pairs of dark dots are recognizable, either immersed in the ventral stripes, or else in contiguity with the inner edges of the stripes. Forceps-basis and the proximal joints of the forceps-limbs usually pale, like the ground-colour of the venter; but the former is usually streaked with light brownish in the parts overlain by the penis-lobes. Setæ in opaque view either pitch-brown or raw-umber, paler towards the tips. Fore leg in opaque view light pitch-brown, inclining to rufo-piceous or burnt-umber. Hinder femora intense raw-umber, very slightly subopaque in

the place corresponding with that of the præterminal band in other species; tibiæ and some part of the tarsi basewards rather lighter than the femora, but the remainder of the tarsi about as dark as the femora. Wings vitreous; neuration in opaque view pitch-black, with the wing-roots and the bases of the longitudinal nervures very light bistre-brown in both wings, and also with the costa of the hind wing to a large extent pale.

♀. Very similar. The ventral stripes in segments 2–6 combine to form wider curves than in the ♂, and the innermost pairs of dark dots stand apart from the stripes; segment 7 has a pitch-black triangular stripe on each side from the base, an ochraceous depression in the midst, and a broad dark-coloured ovivalvular border; segment 8 is bright yellow-ochreous in the midst, and is traversed by a blackish longitudinal stripe on each side, which is continued through the following segments to the base of the seta; segment 9 is edged very narrowly at the sides with yellowish, and traversed longitudinally by an abbreviated median yellowish cuneiform streak tapering forwards from the base of the lobe; the lobe itself is largely occupied by an ochraceous rhomboidal spot truncate anteriorly at the base of the lobe so as to be reduced to the form of an irregular pentagon, and its anterior lateral margins are narrowly ochraceous. Fore legs intense raw-umber. Setæ whitish sepia-grey, sometimes dark near the roots; the joinings for the most part blackish. Length of body, ♂ 11–12, ♀ 13; wing, ♂ 12–14, ♀ 16; setæ, ♂ im. 16–22, ♀ im. 22 mm.

Hab. Colorado and Washington Territory (McLach. Mus.); also (in Mus. Comp. Zool. Cambridge, Mass.) Truckee, Nev. (Crotch, June 10), between Elles and Humboldt, Nev. (S. Henshaw, June 10), Bridger Basin, Wy. (Garman), and Manitou, Col. (Morrison).

The description given above is based mainly upon specimens from Colorado in McLach. Mus. Those from Washington Ter. have the forceps-basis uniformly bistre-brown; and their hinder legs may be almost imperceptibly of a darker shade than those of the typical form. This last difference is slight enough to be attributable to fortuitous causes. In accordance with prevalent usage, the name *brunnea* is restricted to the ♂ imago described by Hagen in 1875, which is a *Rhithrogena*; but in that genus also it will rank as a synonym.

SIPHLURUS ALTERNATUS, Say.

‡ *Baëtis alternata*, Say, Godman's West. Quart. Rep. ii. 304 (1824); Le Conte, Complete Writings of T. Say, i. 204 (1859); Hag., Smithson. Miscell. Coll. (1861), Synopt. Neuropt. N. Am. 49; Walsh, Proc. Acad. Nat. Sc. Philad. (1862), 369; Hag., Proc. Ent. Soc. Philad. ii. 169 (1863); Walsh, *op. cit.* 189 (1863).—‡ *B.* ‖ *annulata*, ! Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 567 (1853); Hag., Smithson. Miscell. Coll. (1861), Synop. Neuropt. N. Am. 48.—‡ *B.* ‡*femorata*, Provancher, Naturl. Canad. viii. 267 (1876); *id.*, Fn. Ent. d. Canad. ii. fasc. i. 83 (1877).

Siphlurus annulatus, ! Etn., Trans. Ent. Soc. London (1871), 127, pl. vi. 4, 4*a* [forceps and ventral markings].—*S. alternatus*, *id.*, *op. cit.* 129 (1871).—*S. alternans* [misprint in corrections for *alternatus*], Provancher, Fn. Ent. d. Canad. ii. fasc. i. 82^{2} (1877).

Subimago.—Wings fumose, with coarser and more distinct neuration than those of the *imago*: neuration and membrane pale greenish at the tips of the hind wings (Walsh).

Imago.— ♂. [Eyes in life pitch-brown, intersected by a black line at their lowest ¼: Walsh.]—(*Dried*). Notum light raw-umber brown, darker along the middle. Dorsum of the abdomen bistre-brown, varied with dull whitish yellow in segments 3–9; the lighter colour in segments 3–8 forms an acute triangle at the base of every segment on each side about half as long as the segment [two triangular yellowish spots, more or less confluent, sometimes extending to the dorsum, in segments 2– or 4–9 (Walsh)]. Venter extremely light ochraceous, with intense burnt-umber brown markings in segments 2–8, viz. :—in each segment two longitudinal stripes, a pair of dots, and a spot or streak; in segments 4–8 the longitudinal stripes extend from near the hinder lateral angles of the segment almost to the base, are gently curved outwards posteriorly, and are slightly convergent towards each other in front; in segments 2 and 3 the stripes are confluent at the base of the segment; in segments 2–8, between every pair of stripes, is a pair of dots placed transversely not quite in the middle of the segment, and these are followed at a short distance in the same segment by an abbreviated streak or lanceolate spot, half overlain at the joining by the margin of the segment, and half projected into the following segment. Setæ ochraceous, with piceous joinings. [Fore legs pale brown (Walsh).] Hinder legs, in opaque view, ochraceous; a broad band before the extremity of the femur, the extreme base of the femur, the knee, the joinings of the tarsal joints and tibia, and the ungues, intense burnt-umber brown. Wings vitreous, with pitch-brown neuration; the bistre-grey tint formerly attributed to the pterostigmatic region is now no longer visible.

♀. Anterior and lateral edges of the vertex, and sometimes the median line, as well as two abbreviated vittæ on each side of it, yellowish. Abdominal markings occasionally indistinct [*teste* Walsh]. Length of body 10–13; wing, ♂ 11–14, ♀ 12–15; setæ, ♂ im. 18–31, subim. 13, ♀ im. 18–19, subim. 14–15 mm.

Hab. Trenton Falls, N. Y. (Brit. Mus.); Rock Island, Ill. (Walsh); North-west Territory (Say); Quebec, Ca. (Provancher).

Siphlurus femoratus, Say [not Etn., in Pl. 18].

‡ *Baëtis femorata*, Say, Godman's West. Quart. Rep. ii. 162 (1823); Le Conte, Complete Writings of T. Say, i. 171 (1859); Hag., Smithson. Miscell. Coll. (1861), Synop. Neuropt. N. Am. 48; Walsh, Proc. Acad. Nat. Sc. Philad. (1862), 368?; Hag., Proc. Ent. Soc. Philad. ii. 169; Walsh, *op. cit.* ii. 188? (1863).—*B. interlineata*, *id.*, *op. cit.* 190?

Siphlurus femoratus, Etn., Trans. Ent. Soc. London (1871), 128.

Subimago.—Wings coloured exactly like those of *Hexagenia bilineata* [see p. 50, *ante*], the bordering of the cross veinlets along the anterior margin of the fore wing forming three dark clouds, of which the intermediate, situated about the bullæ, is the most distinct. Setæ pale brown, with brown joinings.

Imago (*living*).— ♂. Eyes pearly whitish above, with a movable black dot; their lower ¼ (separated by a definite line from the whitish part) pale dusky. Notum piceous. Abdomen in segments 2–6 transparent whitish, each of them, above, bordered narrowly with piceous at the terminal margin, marked in the middle on each side with an obscure oblong spot, and slightly pulverulescent with piceous along the upper part; segments 7 and 8 of the dorsum piceous, each with a semi-oval whitish spot at the base on each side

extending to the middle; the last segment has the sides of the dorsum whitish throughout. Venter transparent whitish; forceps-limbs sometimes whitish only in their longest joint. Setæ whitish, with the joinings alternately broadly and narrowly fuscous. Wings vitreous; in the fore wing, the stronger of the longitudinal nervures, one discal sector with its cross veinlets, the subcostal cross veinlets, and a small more or less obvious spot at the bifurcation of the said sector, brown; a coarse medial black line about a millimetre long immediately behind the radius, and sometimes a slight brown cloud in the pterostigmatic region; in the hind wing one long and one short series of cross veinlets on the basal costa are strongly fuscous and enclose a brown cloud.

♀. Differs from ♂ in having segments 2–6 of the abdomen pitch-brown above, each paler towards the base; and there is no brown cloud at the base of the hind wing. Length of body 12–14; expanse of wing, ♂ 25–28, ♀ 28–29; length of setæ, ♂ im. 20–24, ♀ im. 13–16, subim. 10–14 mm.

Hab. Rock Island, Ill. (Walsh); Cincinnati, Ohio (Say). [After Walsh.]

Siphlurus bicolor, Walker.

Palingenia bicolor, ! Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 552 (1853); Hag., Smithson. Miscell. Coll. (1861), Synop. Neuropt. N. Am. 43.

Siphlurus bicolor, ! Etn., Trans. Ent. Soc. London (1871), 128.

Subimago (*dried*), ♀.—Wings light sepia-grey, the fore wing lighter and more transparent at the base and within the space bounded by the anal (8) nervure; neuration dark; cross veinlets of the pterostigmatic portion of the marginal area of the fore wing about 20 in number, sparingly forked and anastomosing; those of the disk margined with darker grey. Vertex of the head, and also the notum, brown-ochreous. Abdomen discoloured; setæ light yellowish brown. Fore femur dark reddish pitch-brown, the tibia rather less reddish and more piceous, the tarsus very light yellowish white. Hinder femora, in opaque view, extremely light yellow-ochre, changing in transmitted light to pale amber; the tibiæ and tarsi more nearly white; the ungues pitch-brown. Length of body 11, wing 13 mm.

Hab. St. Martin's Falls, Albany River, Hudson's Bay (Barnston, in Brit. Mus.).

Siphlurus mirus, sp. nov.

Imago (*dried*), ♀.—Thorax dark pitch-brown above, varied at and near the peak of the mesonotum with dull light Mars-yellow. Abdomen fulvous or dull Mars-yellow above, varied with brownish, the hinder borders of the intermediate segments black, the bordering produced forwards along the lateral margins of the dorsum from the hinder angles of the segments so as to form acute triangular black spots in segments 2–8, and a black linear streak on each side in segment 9; the median basal dot and two diverging lines of the dorsal segments are visible in at least segments 9–8. Venter nearly of the same colours as the dorsum; segments 2–8 broadly margined with black behind; the black transverse bands, expanded just at their extremities, and narrowly conjoined along the lateral border, are each shortly extended into a projecting point midway between the side and the middle of the segment. Setæ whitish, with reddish joinings.

Fore wings vitreous, their neuration pitch-black somewhat brownish at the wing-roots. Hind wings transparent at the base, but largely occupied by a broad transverse transparent pitch-brown band (an hypertrophied bordering of the terminal margin) which extends from terminal margin to rather beyond the fork of the præbrachial nervure (6), and right across the wing from the costa, following the edge of the wing some distance further in along the inner margin; neuration pitch-black. Femora and tibiæ in opaque view light bistre-brown or bronze-brown, the tibiæ in some positions appearing light or pale dull brownish yellowish; tarsi brownish white, the ungues, terminal joint, and distal borders of the other joints, light burnt-umber or reddish brown. Length of body, ♀ 10, wing 12·5, setæ about 12 mm.

Hab. New Hampshire (Whitney, in Mus. Comp. Zool. Cambridge, Mass.). The conspicuous colouring of the hind wings enables this species to be distinguished at a glance.

Siphlurus typicus, sp. nov.

Subimago (*dried*).—Wings uniformly light bistre-grey, with light bistre-brown longitudinal neuration; the nervures paler close to the wing-roots. Setæ in opaque view bistre-brown, with piceous joinings. Body pitch-brown.

Imago (*dried*).—♂. Notum almost intense brown-ochre, but browner. Dorsum of abdomen in opaque view bistre-brown, modified in segments 7–10 with light brown-ochre; in oblique view the predominant colour changes from bistre- to raw-umber brown, and segments 2–6 become more translucent than the others, especially at their bases; the darker colour in them occupies the middle of the back continuously as a broad longitudinal stripe, extends laterally therefrom along the joinings, and then is suddenly dilated midway towards the pleuræ so as to form a quadrangular spot bounded behind by the terminal margin and below by the hinder half of the lateral margin of the dorsal arc, thus filling the posterior lateral angle; from the upper anterior angle of this spot a dark streak is produced horizontally to the base of the segment, dividing the pale space thereabouts into a subquadrangular spot at the anterior lateral angle of the segment, and a longer portion beside the dark median stripe; in segment 7 the corresponding pale spaces are much more circumscribed in extent. Venter pale, in segments 8 and 9 modified with brown-ochre or ferruginous, and marked faintly sometimes in segments 2–7 with fine lines convergent towards the base of the segment, or U-shaped markings of the pattern common in this genus, which in other specimens are not traceable. Forceps-basis pale in the middle; its lateral borders and the forceps-limbs light brownish. Setæ whitish warm-sepia, with piceous joinings. Fore femur and tibia in opaque view light raw-umber brown, the latter opaque or redder at the tip; tarsus whitish, with narrowly piceous joinings, and with the terminal joint and ungues tinged very faintly with warm sepia-grey; in transmitted light the raw-umber changes to yellowish amber. Hinder femora and tibiæ very light raw-umber brown; the tarsi whitish, tinged (especially in the terminal joints) with warm sepia; their joinings and ungues light reddish. Wings vitreous, with a small brownish cloud along the axillar fold of the fore wing; neuration pitch-black, excepting the fore wing-roots and the bases of the main nervures, and also in

some lights the costa, subcosta, and radius, which are pitch-brown or light pitch-brown.

♀. Very similar. The ventral markings consist of a broad dark longitudinal stripe on each side at a little distance from the pleuræ in segments 2–5 or –6. The joinings of the setæ are more distinctly piceous than in the ♂, and this colour seems to be liable to run together into irregular bands, perhaps only in dead specimens. The terminal joints and the joinings of the other tarsal joints are warm sepia-brown. Length of body, ♂ 9, ♀ 10; wing, ♂ 10, ♀ 11; setæ, ♂ im. 18–25, subim. 11, ♀ im. 15 mm.

Hab. Denham, Mass. (M'Lach. Mus.); Worcester, Mass. (Mus. Comp. Zool. Cambridge, Mass.).

No Japanese *Siphlurus* has yet been described; but in M'Lach. Mus. are 9 adult ♀ specimens (captured by Pryer) of a large species. The colours of the abdomen have been lost, and therefore it is inexpedient to describe the insect.

ONISCIGASTER, M'Lach. 1873.

Illustrations. *Adult* (details), Pl. XXI. 36; (whole figures) see citations under *O. Wakefieldi* of M'Lach. (1873 & 1874). *Nymph* Pl. LI.; see also citations of M'Lach. (1874) and Vayssière (1882).

Adult.—Fore leg of ♂ shorter than the body nearly in the proportion of 14 to 17; tarsus almost $1\frac{1}{3}$ as long as the tibia, and this nearly $\frac{7}{8}$ as long as the femur; gradation of the tarsal joints in the order of lessening length, 1, 2, 3, 4, 5, the first about $1\frac{1}{5}$ as long as the second joint. Fore leg of ♀ little less than half [$\frac{9}{20}$] as long as the body; tarsus about $1\frac{3}{4}$ as long as the tibia, and this $\frac{5}{8}$ as long as the femur; the rank of the tarsal joints in order of diminution is 1, 2 equal to 5, 3, 4, and the first is twice as long as the second joint. Hind tarsus of ♀ about $1\frac{1}{2}$ as long as the tibia, and this little more than $\frac{1}{2}$ as long as the femur; the joints in order of shortening rank 1, 5, 2, 3, 4, and the first is twice as long as the second. Ungues each unlike the other in every tarsus. Hind wing well developed, obtusely subovate; dilatation of the marginal area obtuse in front; axillar region well developed, largely occupied by numerous long anastomosing veinlets from the inner margin. In the ♀ abdomen the relative lengths of segments 2–10 may be formulated thus:—6, 8, 8, 8, 8, 10, 11, 10, 6; the first is thoracoid. Pleuræ of segments 2–5 in ♀ squarely truncate behind; those of segments 6–9 in ♀, or 5–9 in ♂, broadly and oniscoidally dilated, each narrowed and rounded off obtusely in front, and each produced behind into a short acute point separated by a small sinus from the hind border of the segment, so that this part of the abdomen is flanked by very conspicuous serratures; the pleural projections of segment 5 in the ♂ are narrower than the others. The 9th ventral segment is unprovided with a lobe in the ♀. Forceps-basis bipartite; the divisions, explanate, quadrangular, longer than broad, and remote from one another, might be reckoned as basal joints of the forceps-limbs. Forceps-limbs dactyloid, 4-jointed; the first joint short, tapering from the base; the second curved, longer than the others, and very slightly gibbous inside at the base. Penis small, perhaps retracted partially in dried examples. Median caudal setæ of ♂ about $\frac{1}{4}$, of ♀ as long as the body; outer setæ of ♂ about $\frac{8}{9}$ as long as the body. In the ♀

subimago the median seta is about $\frac{1}{3}$ and the outer setæ nearly $\frac{3}{4}$ as long as the body. Oculi of ♂ remote above, oval and very prominent. Vertex of ♀ head about as long as broad, slightly wider in front than behind; the occipital border raised suddenly above the level of the posterior orbits of the oculi. Median ocellus of ♀ much smaller than the others, isolated in a broad descending groove in front of and below the anterior edge of the upper surface of the head. Pronotum of ♀ rather broadly reflexed upon the mesopleuræ; its posterior border (viewed from above) arched, with a very shallow median recess, which is not noticeable when viewed from in front.

Nymph.—Abdominal tracheal branchiæ recumbent upon the dorsum, borne by segments 1–6, diversiform and single, each inserted in a notch in the hind margin of the segment adjacent to the pleura; the foremost oblique, and somewhat resembling a truncate triangle with obtusely rounded angles, placed with the longest side inwards; the remaining five are formed each of a somewhat broadly obovate or oval pergamentose lamina with a large roundly expanded foliated lobe produced from its inner edge [defective in fig. 18], the margins of which are irregularly erose and incised. The tracheation of the lamina gives it a curiously marbled appearance. Antennæ shorter than the head, about 12-jointed in adolescence. Mandibular lobes strong and fang-like; the endopodite well developed; stipes well developed, circumscribed distally by a shallow constriction. Palpus of maxilla I. a little longer than the lacinia; the third joint gradually tapering, pungent, about as long as the second and little shorter than the first, but not quite as stout as either of them; lacinia somewhat lanceolate, with very few hairs on the oblique crown close to the point, and with short ciliæ mingled with a few slender curved spines on the inner edge preceded by a few very short hairs nearer the stipes. Laciniæ of maxillæ II. falcate, nearly of the same breadth as the narrowly ovate-lanceolate lobes of the labium; first joint of the palpus stout; second joint less stout and slightly curved, very little enlarged and almost squarely truncate distally, about as long as the first joint; third joint about half as long as the second, less stout, and somewhat elongate-oval. Median lobe of the tongue subquadrangular, with the distal corners rounded, longer than broad and slightly retuse, subequal in length to the paraglossæ, of which the terminal margins with that of the median lobe constitute together an arcuate curve; paraglossæ dilated distally very moderately. Hind leg a little longer than the fore leg; tarsus (claw excluded) nearly $1\frac{1}{2}$ as long as the tibia. Abdomen carinate above longitudinally in the middle; the carination in segments 2–9 produced into short points, each projecting a little over the base of the next segment; pleuræ in segments 1–9 oniscoidally dilated, forming recurved acuminate serratures. Median seta plumose, the others ciliate inside, each in its distal $\frac{3}{5}$; outer setæ about $\frac{1}{2}$ as long as the body.

Type. O. Wakefieldi, M'Lach.

Distribution. New Zealand.

Etymology. ὀνίσκος and γαστήρ, in reference to the lateral serratures of the abdomen.

Oniscigaster Wakefieldi, M'Lach. Plate XXI. 36 (wings, legs, ♂ head, and forceps).

Oniscigaster Wakefieldi, M'Lach., Ent. Mo. Mag. x. 108–9, woodcut (1873, Oct.); *id.*, Rep. Brit. Ass.

1873, p. 118 (1874); *id.*, Proc. Ent. Soc. London (1874), p. vi; *id.* Journ. Linn. Soc. Zool. xii. 139–146, pl. v. 1–5*g* (1874).

Subimago (*dried*).—Wings, in opaque view, light sepia-grey; neuration generally piceous, but the principal nervures become pale basewards; the cross veinlets situated in the portions of the fore wing bounded posteriorly by the inner and terminal margins, and in front by the outer half of the sector (4) and the inner half of the pobrachial (7) nervures, and all of the cross veinlets in the hind wing are narrowly edged with faint nebulous dark bordering; those in the anterior portion of the fore wing (with the exception of those in the extremity of the pterostigmatic space) are edged more or less broadly with piceous—most broadly so in the marginal, submarginal, and the next adjoining areas,—and their bordering in the basal halves of the first two areas is confluent to a variable extent; between the great cross vein and the last-mentioned cross veinlets the membrane is pale, contrasting conspicuously with the adjacent parts; and in proximity to the wing-roots the base of the fore wing from the radius (3) to the inner margin is somewhat pale, both membrane and nervures; and so again to a small extent is the membrane in proximity to the bifurcation of the præbrachial (6) nervure. Setæ dull pale yellowish.

Imago (*dried*).—♀. Notum dark pitch-brown. Abdomen of a duller colour than the notum on the dorsum, but nearly as dark, probably discoloured considerably in drying; in segments 2–6 the tracheæ appear to be pale and the joinings of the segments dark; the sides of every segment in proximity to the pleuræ are more or less dark; segments 6–9 are traversed lengthwise by a fine median black line, and are marked each by a pair of elongated dark spots or short streaks, one on each side of the line, at the base; the pleural expansions of these segments, and in 9 and 8 a forked longitudinal streak just above them on each side, are also dark. Venter light yellowish brown, with black or piceous markings: the markings comprise in each of segments 2–7 a large blotch on each side, gradually rounded off towards the base of the segment, intersected by the pale descending tracheæ near its anterior termination, and leaving only the joining pale; also a transverse streak at the joining, tapering to a point from the middle in both directions, whence is produced a short pointed streak or triangular cusp pointing forwards in the middle of the hind border of the segment; also a pair of small dots or oval spots, one on each side of the middle of the segment and in proximity to the point of the cusp; also the ventral ganglion nearer the base of the segment in the median line; and, lastly, another pair of larger oval spots set obliquely, and rather wider apart than the smaller spots, one on each side of the middle near the base of the segment; in segment 8 the smaller pair of dots is extremely small, and in 9 they appear to be totally absent, the larger pair alone remaining. Setæ whitish yellow, sometimes discoloured at the base. Wings vitreous, faintly tinted with light brownish [excepting sometimes towards the tips of the fore wings, perhaps in consequence of their having been seized between finger and thumb at the time of capture]; neuration piceous; cross veinlets dark-edged, nearly in correspondence with their edging in the *subimago*. Legs in opaque view dull light brown-ochreous, all with the base of the femur, a broad band before its extremity, one at the base of the tibia, one embracing the tip of the tibia and the basal half of the first

tarsal joint, and all with the extreme tips of the joints of the tarsus and with the ungues black; in transmitted light the ochre changes to dull amber.

♂. Very similar to the ♀, but perhaps rather lighter in colour. Setæ pale dull yellowish. Forceps pale yellowish brown. Length of body 16–21; wing, ♂ 16, ♀ 19–21; setæ, ♂ im. 17 & 5, ♀ subim. 13 & 7 mm.

Hab. New Zealand; Christchurch (Wakefield, in M'Lach. Mus. and Brit. Mus.).

Section 11 *of the Genera.*—Type of *Bætisca*. *Adult.*—In the fore wing the second axillary nervure (9^2) meets the terminal margin close to the anal angle, simulating the usual appearance of the anal nervure and usurping its usual functions: the first axillary (9^1) and anal (8) nervures simulate complete intercalar nervures of the anal-pobrachial interspace, and are immediately adjacent to each other; the third and fourth axillary nervures meet the inner margin before the middle, occupying the usual places of the first and second. Pronotum of minimum proportions; mesonotum excessively developed. *Nymph.*—Palpus of maxilla 1. shorter than the lacinia. Pronotum and the mesonotal sutures undefined in adolescence, the wings being immersed in a large notal hood or shield, which obtects the tracheal branchiæ and a large portion of the abdomen.

BÆTISCA, Walsh, 1862.

Illustrations. Adult (details), Pl. XXI. 37; (whole figure) *subim.* see unpublished drawing by Abbot, Brit. Mus. Cat. MSS. 460 c, vol. xii. pl. 42 bis, No. 662 (1792). *Nymph*, Pl. LII.; see also citations under *B. obesa* of Walsh [with circumspection] (1864) and Vayssière (1882).

Adult.—Fore leg of ♂ little longer than the body [as 8·5 is to 7 or 8]; tarsus scarcely $2\frac{1}{2}$ as long as the tibia, and this little more than $\frac{2}{3}$ as long as the femur; the tarsal joints in order of shortening rank 1, 2, 3, 4, 5, and the first is very nearly $1\frac{3}{4}$ as long as the second joint. Fore leg of ♀ about $\frac{5}{7}$ as long as the body: tarsus barely longer than the tibia, and this about $\frac{2}{3}$ as long as the femur; the tarsal joints in decreasing length rank 1, 5, 2, 3, 4, and the first is nearly $1\frac{1}{2}$ as long as the second joint. Hind tarsus of ♀ about $1\frac{1}{7}$ as long as the tibia, and this $\frac{3}{5}$ as long as the femur; the proportions of the tarsal joints approximate to those of the joints of the fore tarsus, but the first is scarcely $1\frac{2}{5}$ as long as the second joint. Ungues each unlike the other in every tarsus. Hind wings ample, subrotund; dilatation of the marginal area obtusely rounded off in front; axillar region of moderate dimensions, but with plentiful neuration; intercalar neuration unusually long and plentiful; cross veinlets remote from the terminal margin. In both wings cross veinlets are very numerous, and many of them are delicate; in the fore wing they are not restricted from the vicinage of the terminal margin, where many of the longitudinal nervures are provided with short branchlets. Prosternal projection bifid; mesothorax remarkably stout; abdomen relatively short. In the ♀ abdomen the proportional lengths of the 3rd–10th segments may be formulated thus:—6, 6, 7, 14, 7, 7, 7, 6; of the remaining two segments, the first is thoracoid, and the second was not sufficiently traceable for measurement in the dried specimen examined; the pleuræ of segments 7 and 8 are obtuse, those of segment 9 acutely truncate behind; the ventral

lobe of segment 9 is subtriangular, with the apex shortly and acutely excised. Forceps-basis of ♂ entire, slightly retuse in the middle; forceps-limbs 3-jointed, with the first joint nearly thrice as long as broad, the second (the longest joint) somewhat gibbous at its inner base and slightly incurved, and the third joint short. Penis-lobes unarmed, apparently combined into a single acute ovate lamellar intromittent organ, concave above and terminating with a single seminal pore. Median caudal seta atrophied; outer setæ in both sexes $\frac{6}{7}$ to $\frac{7}{8}$ as long as the body; those of the ♀ *subimago*, from $\frac{2}{3}$ to $\frac{5}{8}$ as long as the body. Oculi of ♂ undivided, nearly contiguous above. Vertex of ♀ head somewhat transverse; the occipital margin raised slightly above the level of the posterior orbits of the oculi. Median ocellus of ♀ isolated, a little smaller than the others. Pronotum of ♀ of minimum proportions, reflexed only in the least degree upon the mesopleuræ.

Nymph.—[Pl. LII. was prepared from a cast slough, and consequently a small but appreciable amount of distortion must be allowed for in some of the figures.] Body stout, tapering in its posterior half; integument extensively but very minutely granulated or scabrid. Abdominal tracheal branchiæ, in specimens of advanced grade, completely obtected by the convex mesonotal shield (referred to above in the Sectional description) and [*fide* Walsh] decumbent upon the dorsum in the cavity enclosed thereby; their insertions in segments 2–6 are successively approximated to one another by small degrees. The said shield (in which the fore wings are immersed) differs merely in its larger development from those of the nymphs of *Oligoneuria* and *Ephemerella* (already described), occupying, as it does, not only the interspace between the terminal margins of the wings, but also surrounding their extremities and extending laterally beyond their costal margins to the borders of the dorsum, in which respects it is doubtless in agreement with that of *Prosopistoma*. The lateral margins of the shield are flanged, in continuity with the narrowly dilated pleural margin of the mesothorax, to fit closely those of the subjacent segments; its posterior edge, somewhat cordately sinuate, is received into a slot or furrow in the front of a correspondingly undulated ridge traversing the anterior part of the dorsum of the sixth segment, which is the longest by far of the segments. [In figure 1, owing to displacement in the moulted integument, this is overlapped by the shield, which nearly attains the posterior border of that segment.] In moulting the shield splits longitudinally in the middle; on each side of it two large slightly compressed straight prickles arise, one in the midst and the other at the lateral border a little anterior to it, sloped in front but steep behind, their bases being prolonged forwards; of these the intermediate are the smaller. Above each of the fore wing-roots is a small triangular tubercle. Head shortly bicornute in front; the spikes, horizontally proreet, slightly divergent, and either smooth or (one or both of them) unidentate on the inside near the point, arise from above the anterior border of the upper part of the head, which, viewed from below, forms a prominent transverse ledge emarginate in the middle and receding at the sides. Genæ acutely prominent below the orbits. Antennæ 7-jointed; the last three joints and the second joint are longer than the others. During life (*fide* Walsh) the antennæ are deflexed and lie back in grooves below the oculi. Lobes of the mandibles strong and fang-like; endopodite well developed; outer edge of the stipes minutely eroded. Palpus of maxilla 1. shorter

than the lacinia; the third joint subulate, as long as the second and longer than the first; lacinia nude on the crown, its terminal border beset with numerous curved spines, its inner edge with a small isolated tuft of short hair in the middle. Laciniæ of maxillæ II. narrower than the lobes of the labium, which nearly resemble quadrants of the longer segments of a short ellipse; palpus chelate, the second joint being produced distally on the inner side into a slender conical projection shorter than the terminal joint. Median lobe of the tongue subquadrate, with the terminal corners rounded off, and with the margin slightly mucronate in the middle between them; paraglossæ narrow, distally dilated and rounded off. Hind leg longer than the fore leg; tarsus (claw excluded) about $1\frac{1}{2}$ as long as the tibia. Pleuræ of segments 6–9 of the abdomen narrowly dilated oniscoidally; their outer edges for some distance from the points straight and oblique, and then rounded off. Setæ all of one length, about $\frac{1}{3}$ as long as the body and plumosely pilose. Resident in swiftly flowing rivers on the underside of stones, creeping slowly, but swimming with celerity.

Type. B. obesa (in ‡ *Baëtis*), Say.

Distribution. N. America.

Etymology. Diminutive of Bætis, the classical name of the Guadalquivir, grecised.

Bætisca obesa, Say. Plate XXI. 37 (wings, legs, genitalia).

Baëtis obesa, Say, Journ. Acad. Nat. Sc. Philad. viii. 13 (1839); Pict., Hist. Nat. Névropt. ii. Ephém. 195 (1843–5); Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 563 (1853); Le Conte, Reprint of Say's Works, ii. 112 (1859); Hag., Smithson. Miscell. Coll. (1861) 45.

Bætisca obesa, ! Walsh, Proc. Acad. Nat. Sc. Philad. (1862) 378; ! *id.*, Proc. Ent. Soc. Philad. ii. 187 (1863); ! *id.*, ditto, iii. 200–6, fig. [nymph] (1864); ! Etn., Ent. Mo. Mag. v. 89 (1868); Packard, Guide to Study of Ins. ed. i. 595, fig. 576 [after Walsh] (1870); Etn., Trans. Ent. Soc. London (1871), 101, pls. ii. 6 [wing; misdrawn] & v. 9 [details]; Joly [translation of Walsh 1864], Bull. Soc. d'Etud. Sc. Angers 1878–1879, pp. 157–173, figs. 1–3 [after Walsh] (1880); Vayssière, Ann. d. Sc. Nat. (6) Zool. xi. 4, 5, pl. i. 2 (1881) & xiii. 72–77, pls. vi. 56, ix. 98–99 bis, & x. 99–103 (1882).

Subimago (*dried*).—Wings dark sepia-grey with a narrow transparent colourless space on each side of every cross veinlet in the greater part of the disk, and with broader colourless spaces elsewhere in the parts deficient in cross veinlets, viz.:—in the fore wing a large clear band, broadest in the hinder half of the wing, describing a curve from the anal angle outwards to nearly the middle of the costa, and almost interrupted at the fork of the præbrachial (6) nervure; also a large irregular blotch extending transversely from the costa half across the sectorial intercalary nervures: in the hind wing the base is pale, and the dark ground-colour, very sparsely varied with pellucid spots, extends to some depth along the terminal margin. Setæ light warm sepia-brown.—A specimen from Detroit, Mich., has light yellowish-grey wings varied with dusky; and in the fore wing the lighter colour occupies almost the whole of the space posterior to the anal (8) nervure; also a broad patch, in continuity with that space, extending in proximity to the wing-roots, and near the conjunction of the sector (4) and cubitus (5), to the radius (3); also a band, likewise in continuity with the first-mentioned space, passing straight across to the costa by the fork constituted by the union of the sector (4) with the

second intercalary in advance of the cubitus (5). Setæ, forceps, and legs dull light yellowish; the ungues burnt-umber brown.

Imago (dried), ♀.—Notum rather dark burnt-umber-, or intense warm sepia-brown. Abdomen above dark burnt-umber, varied with lighter, and modified at the sides near the base with blue-purplish grey; venter reddish white, with a longitudinal fuscous line in the middle of the penultimate segment. Setæ pubescent, yellowish white, with rufescent joinings. "Intermediate setæ ferruginous" [Walsh]. Forceps yellowish white. Fore femur light amber-yellow, modified with brown-ochre towards the tip; tibia and tarsus brown-ochreous, with pitch-brown ungues; in transmitted light the light amber predominates. Hinder legs lighter than the fore legs; the tibia and tarsi yellowish white. Wings vitreous; longitudinal neuration of the fore wing translucent light brownish, excepting the bases of the costa, radius, and axillary nervures, which are pitch-brown; the marginal area of this wing contains about 10 very faint cross veinlets before the bulla, and 17 beyond it.

♀. Very similar. Length of body 6–8; wing 9–12; setæ, ♂ ♀ im. 6–7, subim. ♂ 3·5, ♀ 4–5 mm.

Hab. North America; Illinois (Walsh); Indiana (Say); Detroit, Mich. (Mus. Comp. Zool. Cambridge, Mass.); California (M'Lach. Mus.).

The Michigan subimago above described probably agrees with the precocious ♂ referred to by Walsh at the end of his description in 1862.

Provisional Second Series of Group III. of the Genera of the Ephemeridæ.

Adult unknown. *Nymph.*—Palpi of both pairs of the maxillæ multiarticulate; that of maxilla I. far shorter than the lacinia; that of maxilla II. much longer than the lacinia, flagelliform and geniculated. Abdominal tracheal branchiæ diversiform, borne by segments 1–7; the foremost formed each of a narrow membranous lamina with long fringes; those of the second segment are composed of a rounded pergamentose lamina with a fascicle of fibrils annexed to its base; those of the remaining segments have been lost in the unique specimen.

Section 12 *of the Genera.*—Type *nameless.* Separated provisionally from Section 13 [see page 22].

GENUS *and* SPECIES *undetermined.*

Illustrations. Nymph, Pl. LIII. (slough and details).

Nymph-slough.—Antennæ shorter than the head, multiarticulate and subulate, with the first two joints longer and much stouter than the remainder. Labrum transverse and emarginate. Mandibles virtually symmetrical, each with two fang-like lobes projecting inwards nearly at right angles with it almost in the middle; of these the lowest, representing the molar portion of the crown, ends in a short sharp tooth dominating a small excision; the intermediate fang is bifid, with acute unequal points; the extremity of the mandible, narrowed cuneately from the lobes to the points, is slightly incurved and trifid, with the median tooth the longest. Maxilla I. broad; lacinia short, termi-

nating in several (about 5) curved subulate teeth; palpus minute, setaceous, 11-jointed, with the second joint the longest, and the third, nearly equalled in length by the penultimate, longer than any of the remaining joints. Laciniæ of maxillæ II. broadly falcate, almost as broad as the subquadrangular lobes of the labium; palpus 13–14-jointed; the first joint much the stoutest and longest, about half as long as the flagellum; the second joint (the first of the flagellum) longer than any of the others. Terminal margins of the fore wings free. Hind leg little longer than the fore leg; tarsus about $\frac{1}{2}$ as long as the tibia, and this about $\frac{2}{3}$ as long as the femur; all the legs are fringed with hair along their upper edges, and have strongly incurved ungues. Setæ defective; the median plumose, the others ciliated within. Length of body 21 mm.

Hab. Chili (Reed, in M'Lach. Mus.).

Part IV. Read December 17th, 1885.

Third Series of Group III. of the Genera of the Ephemeridæ.

Adult.—Anal-axillar interspace of the fore wing curvilinear-trilateral, subtended by the anal angle and a part of the terminal margin. Forceps-basis of ♂ well developed—its form and that of the penis (especially the latter) facilitate distinctions of genera; forceps-limbs either 4-jointed, with the second joint proportionally very long, or 3-jointed (through coalescence of the first with the second joint), with an enlargement at the base of the proximal joint. *Nymph* [those of section 13 unknown]: palpi of maxillæ I. and II. 2-jointed and geniculated; terminal joint of the palpus of maxilla II. peculiarly pouched. Abdominal tracheal branchiæ [excepting the hindermost in some genera] foliaceous and fringeless, furnished at the base each with a fascicle of fibrils or an annexed lamella filiformly dissected at the edges.

Section 13 *of the Genera.*—Type of *Atopopus. Adult.*—In the fore wing the first axillary-nervure (9^1) meets the inner margin at or near the very obtusely rounded anal angle; the second axillary (9^2), subparallel with and adjacent to the first, receives several branchlets [or curved cross veinlets] from the distal portion of the inner margin which comes between its own termination and that of the third axillary nervure (9^3); the almost straight anal nervure (8) meets the terminal margin rather far in advance of the anal angle; the trilateral, somewhat leg-of-mutton-shaped space [the "anal-axillar interspace"], bounded by the anal and first axillary nervures together with the terminal margin, and attenuated towards the wing-roots, contains a variable number of intercalary nervures, incursive from the terminal margin and commonly grouped together in two couples of unequal length, of which the longer [usually the nearest to the first axillar (9^1)] extends about halfway to the wing-roots. Tarsi of the hinder legs as long as the tibiæ or longer. *Nymph* unknown: perhaps that ranked in section 12.

Absence of requisite materials precludes description of the genera of this section in full detail.

AMETROPUS, Albarda, 1878.

Illustrations. *Adult* (details), Pl. XXII. 38.

Adult.—Fore tarsus of ♂ nearly 5 (about $4\frac{5}{6}$) times as long as the tibia, which is $\frac{3}{4}$ as long as the femur; the tarsal joints in diminishing sequence rank, 1, 3, 2 equal to 4, 5 [the intermediate joints probably vary slightly in their mutual proportions], the first joint about $1\frac{1}{2}$ as long as the second and almost twice as long as the tibia. Fore leg of ♀ about $\frac{3}{7}$ as long as the body; tarsus about $2\frac{2}{3}$ as long as the tibia, and this $\frac{3}{5}$ as long as the femur; the joints in the order of their shortening rank 1, 2, 3 equal to 4, 5, and the first joint is about $1\frac{1}{2}$ as long as the second, and little shorter than the tibia. Ungues mutually dissimilar in every tarsus. In the anal-axillar interspace of the fore wing figured the two intercalary nervures next to the anal nervure are the longest. Hind wings well developed; the dilatation of the marginal area angular in front; the axillar region ample and supplied with abundant neuration, to which the hindermost nervure contributes numerous branchlets. Forceps basis of ♂ deeply and roundly excised, with acute points; forceps-limbs 4-jointed; the proximal joint stout, nearly $\frac{2}{3}$ as long as the second, which is the longest; the other joints short. Ventral segment 9 of ♀ formerly (as was that of *Siphlurus*, erroneously) described as lobeless; but it is just possible that (as in the genus alluded to) a very short obtuse lobe may have been overlooked. Median caudal seta about as long as the others; those in ♀ imago about $1\frac{3}{4}$ as long as the body; in ♀ subimago about as long as the body. ♂ Oculi evenly contoured.

Type. *A. fragilis*, Albarda.

Distribution. Holland.

Etymology. ἄμετρος and πούς, from the excessive length of the ♂ fore tarsus compared with the tibia.

The proportion of the total length of the ♂ fore leg to the body is perhaps only as 11 to 14 approximately; but this estimate rests upon the assumption that the original drawings of the ♂ and ♀ legs were uniform in scale of enlargement, which, though very probable, is not absolutely certain.

AMETROPUS FRAGILIS, Albarda. Plate XXII. 38 (wings, legs, and genitalia).

Ametropus [type] *fragilis*, ! Albarda, Ent. Mo. Mag. xv. 129 (1878); ! Etn. *op. cit.* xviii. 22 (1881).

Subimago (*dried*).—Wings uniformly light smoky grey, with light yellowish or testaceous longitudinal nervures. Setæ testaceous.

Imago (*dried*), ♂.—Notum pitch-brown. Abdomen bistre-brown above, testaceous at the joinings and towards the sides; venter in segments 2–7 yellowish, in 8 and 9 fuscescent; forceps testaceous; setæ whitish. Fore leg testaceous, with the tibia, and the femur distally, dull piceous. Hinder legs somewhat of a light brownish ochre. Wings vitreous; longitudinal neuration light amber-colour; cross veinlets colourless, those in the pterostigmatic portion of the marginal area of the fore wing numerous, mostly simple, and gently curved.

♀. Very similar. Fore leg rufo-piceous, with the base of the femur, the joinings, and the terminal joint of the tarsus testaceous. Setæ very light warm-sepia or cologne-earth

grey, rubiginose at the roots. Length of body 13–15; wing, ♂ 14–15, ♀ 16–17; setæ, ♀ im. 22, subim. 12 mm.

Hab. Holland; near Rotterdam (Fransen) and near Arnhem (Van Medenbach de Rooy) in Albarda's Mus. A single *Ametropus* without locality, in Dr. Hagen's collection, was sent to me amongst *Ephemeridæ* collected chiefly in southern Russia, Caucasus, and Armenia.

ATOPOPUS, Etn., 1881.

Illustrations. *Adult* (details), Pl. XXII. 32.

Adult, ♂.—Fore leg about as long as the body; tarsus about $1\frac{2}{5}$ as long as the tibia, and this nearly $1\frac{1}{5}$ as long as the femur; the tarsal joints in order of shortening rank 1, 2, 3, 4, 5, and the first is about $1\frac{1}{3}$ as long as the second, and nearly $\frac{1}{2}$ as long as the tibia. Hind tarsus twice as long as the tibia, and this about $\frac{7}{1\frac{1}{2}}$ as long as the femur; the joints in order of shortening rank 1, 2, 3, 5, 4, and the first is about $3\frac{1}{9}$ as long as the second, and upwards of $1\frac{1}{9}$ as long as the tibia,—the excess is larger in the intermediate leg. Ungues each unlike the other in every tarsus. In the anal-axillar interspace of the fore wing the two intercalary nervures nearest to the anal (8) are shorter than the other couple. Costal dilatation of the hind wing angular in front; axillar region of minimum proportions. Forceps-basis transverse, widely excised behind, with the sides of the excision convergent towards a narrow low prominence at the bottom. Forceps-limbs virtually 3-jointed. Setæ about twice as long as the body; the median aborted.

Type. *A. tarsalis*, Etn.

Distribution. Borneo.

Etymology. ἄτοπος and πούς, from the strange proportions of the hinder tarsi.

Atopopus tarsalis, Etn. Plate XXII. 39 (wings, legs, genitalia ♂).

Atopopus [type] *tarsalis*, ! Etn., Ent. Mo. Mag. xviii. 22 (1881).

Imago (*dried*), ♂.—Body pitch-black above, with the abdominal pleuræ and terminal segment flavescent; venter and forceps pitch-brown; setæ pitch-black. Fore leg pitch-black; the femur pitch-brown from the base to about the middle; the tarsal joinings whitish beneath. Hinder femora *in opaque view* pitch-brown; tibiæ flavescent; tarsi brownish: *in transmitted light* the femora become translucent brownish, the tibiæ yellow-amber, and the tarsi yellowish with a suffusion of rather deep smoky grey. Wings vitreous, with pitch-brown markings and black neuration; the markings comprise the marginal area of the fore wing beyond the middle and, in part, nearer the base, the submarginal area almost to the base, and a narrow patch on the terminal margin near the anal angle; in the hind wing the apex and terminal margin are likewise narrowly bordered with the same colour. Length of body, ♂, 9–10, wing 11, setæ 20 mm.

Hab. Labuan (M'Lach. Mus.).

THALEROSPHYRUS, Etn. 1881.

Illustrations. *Adult* (details), Pl. XXII. 40.

Adult, ♂.—Fore legs defective in the specimens examined. Hind tarsus as long as the

tibia, and this about $\frac{4}{5}$ as long as the femur; the tarsal joints in order of shortening rank 1, 2, 3, 5, 4—the first is about $1\frac{1}{4}$ as long as the second joint, and not quite $\frac{1}{3}$ as long as the tibia; ungues each unlike the other. In the anal-axillar interspace of the fore wing the two intercalar nervures nearest to the anal (8) nervure are shorter than the next two. Hind wing well developed [defective in the illustrations]; the dilatation of the marginal area angular in front. Forceps-basis transverse, with a small subobtuse projection on each side of its distal margin in proximity to the insertions of the limbs. Forceps-limbs 3-jointed, with the terminal joint minute. Median seta aborted; the outer setæ defective in the specimens examined. ♀ unknown.

Type. Th. determinatus (in ‡*Baëtis*), Walker.

Distribution. Java and the Philippines.

Etymology. θαλερός and σφυρόν, from the size of the ankle or proximal joint of the tarsus.

THALEROSPHYRUS DETERMINATUS, Walker. Plate XXII. 40 (wings, legs [part], forceps).

‡*Baëtis determinata*, ! Walk., List. of Neuropt. Ins. in Brit. Mus. part iii. 567 (1853).

Heptagenia determinata, ! Etn., Trans. Ent. Soc. London (1871), 157.

Thalerosphyrus [type] *determinatus*, ! Etn., Ent. Mo. Mag. xviii. 22 (1881).

Imago (*dried*), ♂.—Piceous with a yellowish stripe down the back, including (*fide* Walker) some piceous marks in the abdominal segments. Setæ in ♀ intense warm sepia-brown. Legs flavescent, the femora broadly banded in the middle and distally with fuscous; both extremities of the tibiæ, and the tarsi also fuscous. Wings vitreous, with the neuration mostly fuscous; the costa of the fore wing towards the base bright yellow-ochreous, but in the marginal and submarginal areas somewhat thickened and pitch-brown. Length of body, ♂ (shrunken) 11; wing 12; setæ, ♀ im. 27 mm.

Hab. Java (Brit. Mus. and Leyden Mus.).

THALEROSPHYRUS TORRIDUS, Walker.

‡*Baëtis torrida*, ! Walk. List of Neuropt. Ins. in. Brit. Mus. part iii. 571 (1853).

Heptagenia torrida, ! Etn., Trans. Ent. Soc. London (1871), 157.

Imago (*dried*), ♀.—Thorax dark rufo-piceous above. Abdomen discoloured, dark at the hinder borders of the segments. Setæ lost. Fore legs very dark rufo-piceous, darker than the notum; hinder legs with femur and tibia translucent light raw-sienna brown, and with tarsus and the tip of the femur light pitch-brown or rufo-piceous. Wings of a light raw-umbre grey tint, the marginal and submarginal areas of the fore wings darker; neuration pitch-brown. Length of body (shrunken) 8, wing 9 5 mm.

Hab. The Philippine Islands.

Section 14 *of the Genera.*—Type of *Ecdyurus*. *Adult.*—Wing-neuration conformable in plan to that predominant in Section 13 of the genera, described at p. 230. Hinder tarsi obviously shorter than the tibia. *Nymph.*—Palpus of maxilla 1. longer than the lacinia. Terminal margins of the fore wings free. Pronotum distinct.

The hind wings of the adult flies are well developed, as a rule, and have the costa sharply elbowed at about the first $\frac{1}{7}$th of the wing's length; the marginal area, moderately

broad at the base of the wing, becomes linear beyond the elbow, and the axillar region is narrow. In *Bleptus* (Pl. LXV. 1) the hind wing is abnormal. The ♂ oculi are almost contiguous with one another above; and, in ♀, the median ocellus is rather smaller than the hinder ocelli.

The items chiefly relied upon for generical classification in this Section are differences noticeable in the relative lengths of joints of the tarsi, and in the forms of the penis-lobes of adult specimens; and also peculiarities of the nymphs. The style of coloration of the wings of subimagines, and the femoral markings (if any) of the flies are likewise of some critical value. But to arrive at a true decision respecting the genus of an individual representative of this type upon these bases, caution and extreme circumspection are often demanded, in view of the following circumstances.

The relative lengths of the tarsal joints of corresponding legs are not strictly invariable in every species of a genus, nor in all specimens of the same sex of a species. The variations noticeable in the fore tarsi of a large series of examples of one species, like the differences between the tarsi of some species and of other species of one genus, may reasonably be suspected to be due either to circumstances attending the last moult, or (in some instances) to marked diversity in the nature of the habitats of the individual nymphs. But apart from such variations, it should always be remembered that tarsi are very subject to deformity. The deformity of a leg in course of reproduction is conspicuous, and familiar to physiologists; no entomologist would be likely to mistake such a leg for a well-proportioned limb. But it does not appear to have been noticed hitherto, that when a nymph has chanced to sustain the loss of a limb in early life, the remaining leg of that pair, although uninjured, is apt to deviate from its proper proportions in the adult fly, through some of its component parts becoming hypertrophied. In this way one or more of the first two or three joints of either of the hinder tarsi may acquire abnormal extension in so slight a degree as to be appreciable only by specialists, and yet quite sufficient in amount to occasion perplexity should unblemished specimens be unobtainable.

When Plate XXIV. was published, this characteristic defect in adult flies grown up from maimed nymphs had not been discovered. Some of the legs there figured were undoubtedly the fellows of limbs in course of reproduction. I have therefore re-drawn and re-measured the legs of representative species of all the genera of this Section (excepting *Pægniodes* and *Compsoneuria*), and quote the results thus obtained both in the tabulated admeasurements subjoined, and in the descriptive letterpress, in lieu of the older data.

The aspect of the penis in dead specimens is sometimes much altered from that normally presented by it during life by convulsive movements made by the moribund insect. Sometimes these lead to extreme extrusion of the lobes accompanied by excessive lateral divergence; but sometimes the contrary action is set up, and the lobes are withdrawn by a process of intussusception either partially or completely, leaving in the latter case nothing but the stimuli visible.

In the nymphs generical distinctions reside chiefly in the abdominal tracheal-branchiæ, in some of the mouth-parts, and in the structure of the pronotum. In repose their

compressed femora protect the tracheal-branchiæ; but in swimming progression is aided by scrambling movements of the legs.

In the "Aid to the Generical Identification" of adult Mayflies of the *Ecdyurus* type, Roman numerals designating the five joints of each tarsus stand at the head of the columns of Arabic numerals which set forth the proportionate lengths of the corresponding tarsal joints of the species named in the left-hand column. The Arabic numerals, in fact, state the millimetric admeasurements of drawings diverse in scale of enlargement, made with the aid of the camera lucida. The figures of the intermediate and hind tarsi are of uniform scale with one another in the same species, but the scale is varied arbitrarily in the different species inversely with the size of the specimens, so as to reduce the dimensions of the longest joints approximately to a common standard of absolute length. Similarly the figures of the fore tarsi are diversified in scale of enlargement with the size and sex of the specimens, irrespectively of the figures of the hinder tarsi of the same species, so as to facilitate the comparison of the proportions of the tarsal joints of the fore leg in all specimens of either sex.

Short Tabulation of Nymphs of Section 14 of the Genera.—Type of *Ecdyurus*.

Laminæ of the foremost abdominal tracheal branchiæ convergent, coming into contact beneath the metasternum; branchial fibrils fasciculated.
- Median caudal seta present in specimens of advanced age ..... *Rhithrogena*. Pl. LIV.
- Median caudal seta entirely absent in aged specimens ..... *Iron*. Pl. LV.

Laminæ of the foremost abdominal tracheal branchiæ widely remote from each other.
- Median caudal seta entirely absent in aged specimens. Branchial fibrils fasciculated ..... *Epeorus*. Pl. LVI.
- Median caudal seta present.
  - Laminæ of the hindermost tracheal branchiæ conspicuously different from the others, being linear-lanceolate instead of broad; branchial fibrils connate for some distance, thus forming a single filiformly multifid membranous appendage to each of the broader laminæ, which are oblique at the base.
    - Broader branchial laminæ obovate-oblong and cuspidate . . *Nameless Gen*. Pl. LVII.
    - Broader branchial laminæ sub-quadrilateral, mostly auricled below at the base and rounded off at the other corners ..... *Nameless Gen*. Pl. LVIII.
  - Laminæ of the hindermost tracheal branchiæ very similar in form to the others; branchial fibrils fasciculated.
    - Branchial laminæ of the intermediate pairs of tracheal branchiæ mostly ovate-triangular and broad ..... *Nameless Gen*. Pl. LIX.
    - Branchial laminæ narrowly lanceolate..... *Heptagenia*. Pl. LX.
    - Branchial laminæ of the anterior pairs of the series ellipsoidal; those of hinder pairs pass gradually from oblong-oval to obovate. In *junior* specimens the laminæ are narrower and trilateral ..... *Ecdyurus*. Pls. LXI., LXII.

Aid to the Generical Identification of Adult Representatives of Section 14.—Type of *Ecdyurus.*

Tabulation showing the proportionate lengths of the joints of the tarsi; the joints of each tarsus are indicated by Roman numerals, their relative lengths by Arabic,—explained at p. 235.

		Fore tarsus.					Intermediate tarsus.					Hind tarsus.					In the fore leg of the ♂	In the fore leg of the ♀	the tarsus is about	as long as the tibia.
		I.	II.	III.	IV.	V.	I.	II.	III.	IV.	V.	I.	II.	III.	IV.	V.				
Epeorus torrentium	♂	14	14	12	10	6	7·5	7	5	4	14	7	6	5	3	14	♂	♀	$1\frac{1}{6}$	$\frac{3}{4}$
,, *alpicola*	♂	15	15	14	10	8														
,, *torrentium*	♀	13	13	9	7	16	8	7	6	4	15	8	6	5	4	15				
,, *alpicola*	♀	12	12	9	7·5	16														
Bleptus fasciatus	♂	20·5	18	16	13	6	9	6	5	4	7	8	5·3	4·2	3	7·5	♂	♂	$1\frac{1}{4}$	$1\frac{1}{3}$
Iron longimanus	♂	21	19	19	15	7	7	7	7	4	12	6	6	6	3·5	12	♂	♀	$1\frac{1}{3}$	$1\frac{1}{3}$
,, *nitidus*	♀	12	16	16	6	12	..	..	..	..	..	6	6	6	3	11	♀	♂	$1\frac{1}{3}$	$1\frac{1}{3}$
Cinygma integrum	♂	14	22	23·5	15	7	8	8	8	4	9	8	7	6	3	10	♂	♂	$1\frac{1}{3}$	$1\frac{1}{3}$
,, ,,	♀	12	14	12	7	12	..	..	..	..	..	..	..	..	..	..	♀	♂	$1\frac{1}{3}$	$1\frac{1}{3}$
Rhithrogena semicolorata	♂	4	20	20	16	6	5	6	5	3	11	5	5	4	2	11	♂	♀	$\frac{2}{3}$	$\frac{2}{3}$
,, *aurantiaca*	♂	4	20	21	15	7														
,, ,,	♂	4	21	22	14	7														
,, *semicolorata*	♀	7	14	12	7	12	5	6	5	3	10	5	5	4	2	11	♀	♀	$\frac{2}{3}$	$\frac{2}{3}$
,, *aurantiaca*	♀	6	13	10	6	13														
,, *nivata*	♀	7	13	9·5	6	16														
Perlodes cupulatus	♀	6	13	11	5	6	5	7	7	2	5	5	7	7	3	5	♀	♂	$\frac{3}{4}$ to $1\frac{1}{3}$	$\frac{3}{4}$ to $1\frac{1}{3}$
Heptagenia gallica	♂	5	20	20	11·5	7	5	7·5	7·5	3·5	12	5	6·5	6·5	3	12	♂	♀	$\frac{3}{4}$ to $1\frac{1}{3}$	$\frac{3}{4}$ to $1\frac{1}{3}$
,, ,,	♀	6	18	17	7·5	16	5	8·5	8	4·5	15	6	7·5	7	4	15	♀	♂	$\frac{3}{4}$ to $1\frac{1}{3}$	$\frac{3}{4}$ to $1\frac{1}{3}$
,, *sulphurea*	♀	6	15	13	7·5	12	5	9	7	4·5	11	5	7	5·5	3·5	11	♀	♀	$\frac{3}{4}$ to $1\frac{1}{3}$	$\frac{3}{4}$ to $1\frac{1}{3}$
Compsoneuria spectabilis	♀	12	15·4	10·7	5·4	8	..	..	..	..	..	8	7·2	4	2·4	8	♀	♂	1	1
Ecdyurus helveticus	♂	5	16	17	11	6	8	8	6·5	5·7	11	8	7	6	4	11	♂	♀	2	2
,, *venosus*	♂	11	21	20	13	8	10	10	9	5	15	8	8	7	4·5	14	♀	♀	$\frac{3}{4}$ to $1\frac{1}{2}$	$\frac{3}{4}$ to $1\frac{1}{2}$
,, *helveticus*	♀	12	21·6	16·2	12	19·7	8	8·5	7	5·2	13	9	8	6	5	14				
,, *venosus*	♀	12	13·8	12·9	7·3	13·8	..	..	..	..	..	10	7	6·5	5	14				
,, *fluminum*	♀	12	14·4	12	7·2	13·2	7	6	5	3·5	9	7	5	4·1	3	10				
,, *italicus*	♀	12	18	14·4	8·4	15·9	7·5	7·5	6	4	10	8	7·2	6	4	12				

The species described by Walsh under the names of *Heptagenia simplex, pulchella, terminata, maculipennis,* and *cruentata,* are probably not congenerical with any of those in the foregoing tabulation. They probably represent undescribed genera, and possibly some of the three of which the nymphs are figured in Plates LVII., LVIII. and LIX., and are described in the letterpress immediately before the restricted genus *Heptagenia.* The species in question will be dealt with in the Appendix.

EPEORUS, Etn., 1881; restricted [in Pl. XXIV.] 1883.

Illustrations. *Adult* (details), Pl. XXIV. 44 A. *Nymph*, Pl. LVI.

Adult.—First joint of the hind tarsus rather longer than the second; first joint of the fore tarsus commensurate with the second joint; ungues of the ♂ fore tarsus alike and obtuse; penis lobes of moderate breadth, produced outwards a little at their extremities. Fore leg of ♂ about as long as the body: tarsus about $1\frac{1}{6}$ as long as the tibia, and this about $1\frac{1}{4}$ as long as the femur; the tarsal joints in order of shortening rank 1 equal to 2, 3, 4, 5. Fore leg of ♀ about $\frac{7}{10}$ as long as the body; tarsus about $\frac{3}{4}$ as long as the tibia, and this about $1\frac{2}{3}$ as long as the femur; the tarsal joints rank as in the other sex. Hind tarsus of ♂ about $\frac{2}{3}$ as long as the tibia, and this about $\frac{4}{5}$ as long as the femur; joints 1–4 of the tarsus diminish successively in length by small gradations. Ungues of the ♂ fore tarsus alike, broad and obtuse; those of the hinder tarsi and also of the ♀ fore tarsus each unlike the other. Hind wings of ordinary form; the axillar region narrow, but with sufficient neuration. In the ♀ abdomen the relative lengths of the dorsal segments 2–10 may be formulated thus:—7, 9, 12, 12, 12, 10, 10, 5, 5; ventral lobe of the ninth segment retuse. Forceps-basis of the ♂ produced behind into short divergent lobes for the support of the forceps-limbs; the short proximal joints of the limbs combine with the second joints so as to constitute a gibbous enlargement at the base of each limb. The seminal ducts terminate near the extremities of the penis-lobes; stimuli not obvious. Outer caudal setæ of ♂ about thrice, of ♀ $2\frac{1}{2}$–3 times, the length of the body. Vertex of ♀ head transverse; the edge of the occiput ascends from the middle towards the posterior orbits of the oculi in even curves; median ocellus somewhat isolated, moderately prominent, in dried examples, below the front border of the upper surface of the head. Pronotum of ♀ excised, or sometimes cordately excised in the middle behind; the reflexed lateral lobes rounded below and somewhat straightened behind.

Subimago.—Wings tinted with greyish; the neuration opaque; the bordering of the cross veinlets (when developed) inconspicuous. During repose the insect protects its fore legs a little apart, and the setæ are only separated to a small extent.

Nymph.—Abdominal tracheal branchiæ obliquely reclinate or decumbent at the sides, with short scanty suberect fasciculate fibrils; laminæ of the foremost pair far apart, each a little longer than broad and obliquely ovate; hinder laminæ nearly uniformly oval, with the outer or inferior margins thickened and ciliate; the fourth lamina on each side is the longest, and those anterior to it diminish successively in size less than the three that follow: branchial tracheæ well defined, laxly and delicately arborescent, distributed chiefly towards the thinner parts of the laminæ. Median caudal seta totally absent; the two little longer than the body, and glabrous. Pronotum well defined, truncate posteriorly; its lateral borders undilated, rounded off at the front corners, but subparallel behind. Fangs of the mandibles unequal, compressed, denticulated at the tips; the exterior fang broad and only moderately acute; the interior fang much shorter and smaller; endopodite absent, represented only on the left mandible by an inconspicuous tuft of hairs. Lacinia of maxilla I. nude externally, and terminated by three subequal subulate fangs; first joint of the palpus stout, enlarged only slightly towards

the base; second joint clavate, obliquely truncate and densely velutinous at the end, and acute at the tip. Median lobe of the tongue subquadrangular, longer than broad; paraglossæ obliquely truncate, broadest at about the middle. The dark markings of the femora on the coloured side comprise a pair of short opposite longitudinal streaks near the base, separated by a narrow interval from three other longitudinal streaks, of which the two longer extend to the tip, and the shorter is contiguous with the lower edge; these three combine partially to form an irregular submedian fascia; a dot in the interspace between the basal and distal groups of streaks is coalescent with the lower streak of the former group.

Type. *E. torrentium*, Etn.

Distribution. Europe, Armenia, and North America. A Himalayan insect also is ranked provisionally in this genus.

Etymology. ἐπήορος, soaring on high.

The Armenian and American species, communicated by Dr. Hagen, are undescribed. A single pinned specimen from the former province is in his own cabinet; and from the latter continent three nymphs in alcohol, exhibiting the normal structure, are in Mus. Comp. Zool. Cambridge, Mass., registered 22*c*, Wenas V., W. T., Taylor's 6, vii. 1882. Before *Iron* and *Cinygma* were recognized as genera, other specimens than those above referred to were returned as species of *Epeorus*, Etn. MS.

The generical identification of the nymph was established by an exhaustive examination of the fauna of sites in a mill-stream frequented by the imago of *E. torrentium* at Tarascon (Ariège). The subimago was observed to take flight at places where the water rippled strongly over submerged stones; the stream was nearly waist-deep, and the strength of the current rendered the employment of a water-net indispensable to the capture of the nymphs lurking beneath the stones. This mill-stream is close to the highway above the town.

In insects of this genus the coloration of the body is often difficult to define, owing to the superficial tissues differing in hue from more deeply situated pigmentary matter visible through them. The pattern of the ventral markings affords an easy means of distinguishing the species of adult specimens.

Epeorus geminus, sp. nov.

Imago, ♂.—(*dried*.) Notum brown-ochreous, darker behind. In each of the ventral segments 3–7 a single narrowly obcuneate, or obovate-lanceolate, dark spot contains before the tip of the segment a pair of pale dots. In dorsal segments 2–8 the terminal margin is dark, excepting at the pleuræ, the hinder angles of which are of a light colour; and the dark colouring is continued from the said margin on each side, descending forwards obliquely in a gentle curve to the main trachea, and, running onwards along it, terminates at the place of the branching-off of the dorsal trachea.—(*Living*.) Eyes warm sepia-brown. Notum bistre-brown, darker laterally and posteriorly. Dorsal abdominal segments 2–8, light brownish yellow at the base and sides, bordered broadly with pitch-brown along the greater part of the terminal margin, and striped obliquely with the same colour on each side, the stripes descending from the bordering nearly to the middle of the lateral

margin; the remaining segments darker. Venter traversed lengthwise by a median very light burnt-umber stripe, which in segments 1–7 is dilated more or less broadly, posteriorly, so as to form a series of obovate or obovate-lanceolate spots. Setæ piceous, with the joinings of the more attenuated portions opaque. Fore leg piceous, with the basal $\frac{1}{3}$ of the femur above (like the trochanter) either yellowish brown or rufo-piceous. Hinder femora (*dried*) light raw umber or yellowish brown, with a fine very indistinct dark longitudinal streak in the midst; tibiæ yellower than the femora; tarsi light bistre-brown; in transmitted light the femur becomes brownish amber, and the tibiæ yellowish amber. Wings vitreous, tinged in the pterostigmatic region of the fore wing with bistre-grey; neuration piceous, excepting the proximal extremities of the longitudinal nervures posterior to the radius, the costa of the fore wing at the roots, and that of the hind wing in the vicinage of the salient angle. Length of body 14–15; wing 16; setæ, ♂ im. 40 mm.

Hab. Portugal; common by a stream from the Estrella, S. of Sabugeiro (4200 ft., 10·30 A.M., 7th June, 1880, water 56° F.). In the living insect the tips and median streaks of the hinder femora are blackish.

Epeorus assimilis, sp. nov.

Subimago ? (*dried*).—Wings light bistre-grey, with bistre-brown neuration; the wing-roots lighter and pale yellowish.

Imago ♂ (*dried*).—Notum pitch-black, or pitch-brown in front and pitch-black behind. In each of the ventral segments 3–7 a single broadly obcuneate dark spot contains a pair of ill-defined pale and mostly elongate dots. In dorsal segments 2–8 the terminal margin is dark excepting at the pleuræ, the hinder angles of which are of a light colour; and the dark colouring is produced forwards from the said margin in a curve through the scar of the nymphal tracheal branchia on each side of the segment, terminating thereabouts and not extending to the place of the branching-off of the dorsal segmental trachea. Fore leg piceous, in some lights somewhat rufo-piceous along the upper edge of the femur, but less distinctly so than in *E. geminus*. Hinder femora light bistre-brown, very indistinctly banded with darker in the middle; tibiæ and tarsi in opaque view rather lighter than the femora, but only in a slight degree, with the tarsal joinings brownish and the ungues piceous; in transmitted light the hinder tibiæ are of a yellower amber-colour than the femora. Wings vitreous, tinted slightly, or sometimes strongly, towards the base with light yellowish-green, and tinged with sepia-grey in the pterostigmatic region of the fore wing; neuration pitch-black, with the same exceptions as in *E. geminus*. Length of body 14; wing, ♂ 15–16, ♀ subim. 17; setæ, ♂ im. 35–45 mm.

Hab. France and Belgium; near Pau, in the Néez, above the Pont d'Oly (600 ft., June 4, 1878). Also the Schwarzwald, Baden (M'Lach., end of July 1835), where it occurs at altitudes of 2200–2700 ft.

Epeorus alpicola, Etn. (restricted).

Heptagenia alpicola, ! Etn., Trans. Ent. Soc. London (1871), 148 [excl. Carinthian examples & pl. vi. 19, detail of *Ecdyurus Zelleri*].

Imago (*dried*).—Notum varying from reddish umber or Vandyke-brown to rufo-

piceous or almost to brown-ochre, and commonly traversed by a darker longitudinal median stripe in front. The ventral markings in segments 1–8 compose a continuous median dark stripe dilated in the middle of each of the segments (although not always distinctly so in some of the hinder segments): the usual pale dots are indistinct or absent. In dorsal segments 1–8 the terminal border is very distinctly edged with dark colouring, which extends almost to the lower margin of the hinder lateral angle, and which, in lieu of running forwards in a curve at the side of the segment, exhibits at most only a short acute projection barely reaching the edge of the scar of the nymphal tracheal branchia. (*Living.*)— ♂. Eyes roman sepia-brown. Notum either fusco-luteous, or pitch-brown varied with pitch-black. Superficies of the dorsum light bistre, or greenish grey; the underlying tissues especially in segments 8–10 are often tinged in some measure with orange or yellowish: at the terminal margin segments 1–8 are bordered narrowly and somewhat evenly with piceous, and the bordering almost extends to the lateral margins of the hinder angles of the pleuræ in segments 1–7; but in segment 8 it ceases at the pleuræ so as to leave the hinder angles of the segment wholly of the lighter colour; in segment 9 a triangular streak of a similarly dark colour extends on each side in proximity to the pleura from the terminal margin to the base of the segment. Moreover in every abdominal segment the dorsal vessel is bordered on both sides with light brownish, this colouring forming in segments 4–6 twin triangles, acuminate behind, having the track of the vessel as their common base adjacent to their acute angles. Venter light yellowish olive-grey, tinged in the penultimate segment with brown-ochre, and traversed lengthwise by an extremely light jecinoreous or burnt-umber stripe in segments 1–7, which is dilated angularly in the middle of each segment so as to be resolvable into a continuous series of hexagonal spots, broad in the anterior segments and elongated in the hinder segments; in each of these spots are the usual pair of pale dots beyond the middle, and three longitudinal dark lines (the dark borders of the nerve-trunks visible through the integument) in front. Forceps olivaceous or warm sepia-brown, with the last two joints dusky inside. Setæ warm sepia-brown, becoming more intense towards the roots. Fore femur pitch-brown or rufo-piceous, the tibia and tarsus darker, with the distal edges of the intermediate tarsal joints whitish: *when dried* the femur *in opaque view* becomes bistre-brown, with the lower edge dark for some distance from the base, and with faint indications of a dark broadly diffused streak a little before the middle; the tibia and tarsus become pitch-brown or pitch-black; *in transmitted light* the femur becomes brownish amber-colour, the tibia more opaque than it, and the tarsus subequal in translucency to the femur. Hinder femora pitch-brown, dark at the tips; tibiæ dull reddish pitch-brown; tarsi black or pitch-black: *when dried* the femora *in opaque view* become light bistre-brown, each dark at the tip and with a dark longitudinal streak almost from the base nearly to the middle, tapering at both ends; and the tibiæ and tarsi become pitch-brown. Wings vitreous, tinged with bistre-brown or sometimes bistre-grey in the pterostigmatic region of the fore wing: neuration in opaque view black, in transmitted light pitch-brown, excepting at the bases of the wings, where the colouring of the main nervures becomes deficient or at most light raw-umber brown.

♀ (*dried*).—Notum more of a brown-ochre than in the other sex, whence an approach in general appearance is made to *E. torrentium* ♀ ; but the ventral markings of *E. alpicola* ♀ conform to those of the ♂ and suffice to distinguish the species. The pterostigmatic region of the fore wing is only slightly tinted with bistre-grey. Length of body, ♂ 12–14, ♀ 13–14; wing, ♂ 14–16, ♀ 15; setæ, ♂ im. 36–44, ♀ im. about 33 mm.

Hab. The Bernese Oberland, and from the Pennine to the Rhætian Alps, at altitudes of about 3000–6000 ft. Switzerland : Meyringen, near the Alpbach (M^c^Lach.) ; a torrent between Champéry and Tervin, Valais (4500 ft. 14 August, 6 P.M., water 50° F.) ; the St. Gothard (M^c^Lach.). Savoie : les Contamines (about 4000 ft) ; Chamounix (M^c^Lach.). Italy : Macugnaga, Val Anzasca (about 5000 ft., M^c^Lach.) ; the Oglio, in Val Mazza, near Ponte di Legno (5800 ft. 29 July, 5 P.M., water 49 F.).

Epeorus torrentium, Etn. Plate XXIV. 44 A (legs & penis) & LVI. (nymph).

Epeorus [type] *torrentium*, ! Etn. Ent. Mo. Mag. xviii. 26 (1881).

Subimago (*living*).—Wings cinereous with olivaceous or bistre-brown longitudinal nervures and dark-edged black cross veinlets. Fore legs piceous ; hinder legs olive- or bistre-brown with black tarsi. Eyes blackish green. Setæ blackish with opaque joinings. (*Dried.*)—Wings light bistre-grey in opaque view, with raw-umber longitudinal nervures, and black cross veinlets narrowly margined with light grey ; the wing-roots lighter.

Imago (*dried*).— ♂ . Notum light brown-ochre, sometimes modified posteriorly with faint traces of light bistre. The ventral markings form a continuous series of spots diminishing in breadth inversely with the lengthening of the segments : in ♂ the spot in segment 5 is narrowly spathulate, those in segments 7 and 8 are sublinear, that in segment 3 broadly pyriform, and that in segment 2 almost semicircular ; the usual pairs of pale dots or spots are distinct as well as the three or four fine dark lines alongside of the nerve-trunks. In dorsal segments 2–8 the terminal margin is dark excepting at the pleuræ and in close proximity to them ; the dark colouring, leaving the hinder angles of the segment pale, is suddenly produced forwards in a curve from the said margin to the scar of the nymphal tracheal branchia, and, distinctly skirting the upper and the front edges of the scar, either terminates in the pleura at about the middle of the segment, short of the actual edge, or (in some examples) is very faintly traceable beyond that up to the place of the branching-off of the dorsal segmental trachea ; in ♀ the edges of the said branchial scars are dark all round. Fore leg in opaque view :—femur pitch-black lengthwise below and either light bistre or dull rufo-piceous above ; tibia and tarsus pitch-black or pitch-brown : in transmitted light the femur becomes translucent piceous, the tibia and tarsus or sometimes only the tarsus bistre-brown. Hinder legs in opaque view dull yellowish brown, with the tarsi in some lights dull reddish brown, and with an ill-defined blackish band nearly in the middle of each femur ; in transmitted light the prevailing colour is an impure pale brownish amber, the ungues and the distal edges of the tarsal joints, however, remaining opaque and brownish. Wings vitreous ; the pterostigmatic region of the fore wing almost imperceptibly tinted with greenish grey :

neuration in some lights pitch-black, in others pitch-brown, the cross veinlets in some positions remaining of the darker colour while the longitudinal nervures become pitch-brown; in both pairs of wings the subcosta is dark throughout, but the other main nervures become more or less deficient in colouring near the wing-roots. Setæ sepia- or warm sepia-brown at the roots, lighter distally, with dark joinings. The living ♂ is described in the publication cited above.

♀ (*living*).—Eyes greenish, intersected by a fusco-piceous line, and exhibiting a moveable black spot. Very similar in colour and markings to ♂. Dorsum of abdomen in segments 2–7 either fusco-luteous or light bistre-brown, with a rounded pale space on each side extending some distance from the base of each; segments 8–10 brown-ochreous: in each of the intermediate segments the recurved stripes from the dark terminal bordering are piceous, and there is a dark median longitudinal streak from which the colouring spreads outwards for a short distance along the basal margin of the segment; the median streak disappears in the process of drying. Length of body, ♂ 11, ♀ 13; wing, ♂ 12, ♀ 15; setæ, ♂ im. 28–29, subim. 17, ♀ im. 22–26, subim. 19 mm.

Hab. Southern France, and perhaps Northern Italy: August and September. Common at Tarascon (Ariège), inhabiting the conduit above the town as well as the main stream (1560 ft., August 25th, afternoon and evening, water 64° F., and Sept. 1st). A ♀ subimago doubtfully referred here was captured between Lovere and Breno in the Val Camonica (770 ft., August 3rd, 3.30 P.M., water 66° F.). This specimen (*dried*) has very light sepia-grey wings, with pitch-black neuration and pale yellowish wing-roots. The Oglio and Ariège in the places specified have apparently a similar water-climate, and are inhabited by *Oligoneuria rhenana*; therefore it is not improbable that the same species of *Epeorus* is common to both. My hesitation as to the identification of the Italian insect proceeds from the slight colour-differences noticeable between the single examples of subimago available for comparison; but these may be due solely to disparity of age.

Care must be taken to distinguish this species from *Ecdyurus fluminum* ♀.

Epeorus psi, sp. nov.

Imago (*in spirits*).—♂. Body discoloured. The abdomen exhibits black markings upon a lighter ground-colour, viz.:— on the dorsum, in segment 2 a small round median spot; in segments 3 and 4 corresponding single trilobate spots; in segments 5–9 corresponding single tridents or ψ-oid markings, each formed of a median longitudinal line in combination with oblique stripes ascending the sides of the dorsum. The ventral markings in each of segments 2–7 comprise a very fine longitudinal median line produced forwards from the hinder part of the segment, sometimes partially effaced anteriorly, and a pair of fine tapering streaks, one on each side of the median line, mutually convergent towards the base of the segment. Each femur has a neatly defined black spot nearly in the middle, and is darkened towards the knee; ungues each unlike the other.

♀. Ventral lobe of segment 9 very slightly emarginate in the middle. Length of body, ♂ 15, ♀ 18; wing, ♂ 16, ♀ 22–24; setæ, ♂ and ♀ im. 40 mm.

Hab. Kooloo, Himalaya (Rev. M. Carleton, Mus. Comp. Zool. Cambridge, Mass.).

BLEPTUS, gen. nov.

Illustrations. *Adult* (detail) Pl. LXV. 1.

Adult.—First joint of the hind tarsus rather longer than the second; first joint of the ♂ fore tarsus also longer than the second; ungues each unlike the other; penis lobes when dried conformable to those of normal species of *Rhithrogena*; hind wings unusually small, destitute of axillar neuration.—Fore leg of ♂ about $1\frac{1}{2}$ as long as the body; tarsus nearly $1\frac{1}{4}$ as long as the tibia, and this about $1\frac{5}{13}$ as long as the femur; the tarsal joints in the order of their shortening rank 1, 2, 3, 4, 5. Hind tarsus of ♂ about $\frac{1}{3}$ as long as the tibia, and this $1\frac{3}{11}$ as long as the femur; the tarsal joints in order of shortening rank 1 equal to 5, 2 subequal to 3, 4. Ungues in every tarsus each unlike the other. Forceps-basis of ♂ bifid, but only slightly emarginate in the middle of its posterior border, and not produced into projecting lobes at the bases of the limbs; the short proximal joint of each limb is well defined. Penis lobes tubular, curved very slightly outwards, but contiguous at the roots; orifices of the seminal ducts terminal. Outer caudal setæ of ♂ $3\frac{1}{2}$ as long as the body. Only the adult ♂ is known.

Type. *B. fasciatus*, sp. nov.

Distribution. Japan.

Etymology. βλεπτός, worth seeing.

BLEPTUS FASCIATUS, sp. nov. Plate LXV. 1 (hind wing).

Imago (dried) ♂.—Notum dark brown-ochre. Dorsum of abdomen light brown-ochre, with the joinings of the segments and a fine longitudinal median line pitch-brown or intense warm sepia; segments 8–10 rather darker than the others: venter spotless. Setæ warm sepia-brown, dark at the roots. Forceps-limbs slightly brownish; the basis concolorous with the venter. Femora and tibiæ *in opaque view* light raw-umber brown, dark just at the knee, and piceous at the extreme tip of the fore tibia: tarsi dull light yellowish, the fore tarsus approaching the lightest tints of Roman ochre or raw sienna, and having the terminal joint and ungues light raw-umber brown; but the hinder tarsi are lighter and more uniform in tint. *In transmitted light* the general colouring of the femora and tibiæ becomes a rich yellow amber, and that of the tarsi whitish amber, with the joinings of the hinder tarsi slightly opaque. Wings vitreous, with brownish or greyish markings: *in opaque view* of the fore wing the marginal and submarginal areas are of a light raw-umber brown tint, which in the pterostigmatic region acquires a slight degree of opacity; a narrow, irregular fascia, curved outwards a little, and of rather a greyer brown (approaching light bistre) than the said areas, crosses the wing almost directly from the radius to the vicinage of the extremity of the anal nervure, and thereabouts becomes slightly dilated, running inwards a little along the margin of the anal-axillar interspace; a cloud of the same colour as the fascia, concave inwards, occupies the extremity of the wing posterior to the radius, and the same colouring borders more or less narrowly the remainder of the terminal and inner margins: *in transmitted light* very little difference is perceptible between the tint of the marginal and submarginal areas, and that of the markings of the remainder of the fore wing. A broad intense

sepia or brown-black border surrounds the tip of the hind wing, and, narrowing gradually, terminates anteriorly where the costa first comes into proximity to the subcosta, while posteriorly its extremity is nearly coincident with that of the anal (8) nervure. Wing-neuration, in opaque view, for the most part pitch-black; but that of the colourless portion of the hind wing is pale; and in the fore wing the subcosta and radius outside the pterostigmatic region, together with the interjacent cross veinlets and parts near the subcosta of the cross veinlets in the adjoining portion of the marginal area, and also the near extremities of the main nervures posterior to the radius, are light raw-umber. Length of body 10; wing 13; setæ, ♂ im. about 35 mm.

Hab. Japan; Yagohara, 29th July (G. Lewis, in M'Lach. Mus.).

IRON, Etn., 1883 [in Plate XXIV.].

Illustrations. *Adult* (details), Pl. XXIII. 44 [*Epeorus*] and Pl. XXIV. 44 [*Iron*]. *Nymph*, Pl. LV.

Adult.—First joint of the hind tarsus equal to the second and third joints respectively; the corresponding joints of the intermediate tarsus similarly proportioned; first joint of the ♂ fore tarsus longer than the second, which is equal in length to the third joint; first joint of the ♀ fore tarsus shorter than the second, and this equal to the third joint; ungues mutually dissimilar. Penis lobes apparently liable to be deformed through desiccation; in the typical species they are comparable to those of *Thalerosphyrus* (Pl. XXIII. 40), but are not so broad; but in the other species they seem to be tubular and contiguous, somewhat as in *Bleptus* or species of *Rhithrogena*.—Fore leg of ♂ about as long as the body; tarsus about $1\frac{1}{3}$ the length of the tibia, and this about twice as long as the femur; the joints in the order of their shortening rank 1, 2 equal to 3, 4, 5. Fore leg of ♀ about as long as the body; tarsus about $\frac{3}{5}$ the length of the tibia, and this about $1\frac{1}{10}$ as long as the femur; the joints in the order of their shortening rank 2 equal to 3, 1 equal to 5, 4. Hind tarsus of ♂ about $\frac{3}{7}$ as long as the tibia, and this very nearly as long as the femur; its joints in order of their shortening rank 5, 1–3, 4, and the first three joints mutually equal in length are each about half as long as the fifth joint. Ungues in every tarsus each unlike the other. Hind wings of ordinary form; the axillar region narrow, but with sufficient neuration. In the ♀ abdomen the relative lengths of the dorsal segments in dried examples may be formulated thus:—7, 9, 10, 10, 10, 10, 8, 6·5, 6; ventral lobe of the ninth segment slightly emarginate. Forceps-basis of ♂ seldom conformable to that of *Rhithrogena*, but usually tridentate, or saliently curved behind between the insertions of the limbs. Penis lobes either as in *Rhithrogena*, or else narrow and split lengthwise along their inner sides; stimuli well developed in the type, but not obvious in the other species, perhaps retractile. Outer caudal setæ of ♂ about 4 times, those of ♀ about twice, as long as the body. Vertex of the dried ♀ head transverse, convex from side to side: the occipital border when not retuse is scarcely prominent in the middle, and almost even with the posterior orbits of the oculi; median ocellus somewhat isolated, prominent, but rather below the anterior border of the upper

surface of the head. Pronotum of ♀ somewhat cordately excised behind; the reflexed lobes rounded.

Subimago.—Wings yellowish or greyish in tint; neuration opaque, not edged with greyish.

Nymph intermediate in character between *Epeorus* and *Rhithrogena*.—Abdominal tracheal branchiæ disposed as in the latter genus, with short sparse fasciculate fibrils; laminæ of the foremost pair very large, transverse, narrowly subreniform with the sinus eccentric, in mutual contact at their inner extremities beneath the metasternum; laminæ of the intermediate pairs obliquely reclinate at the sides, lessening successively in breadth from the foremost, and also in length (but in both directions) from the third and fourth pairs, each of them oblique, more or less broadly ovate and subacute, with the outer or inferior margin thickened and ciliate; laminæ of the hindermost pair obliquely conduplicate and incurved so as to meet at the tips when deflected beneath the penultimate segment: branchial tracheæ distinct, pinnately branched, but largely deficient towards the thickened portion of the lamina (which part is broader in *Iron* than in *Epeorus*), and both coarser and sparser than in the preceding genus. Pronotum transverse, short: the hind margin uneven; the lateral margins undilated and mutually subparallel. The markings on the coloured side of the femora comprise two groups of longitudinal streaks with a rounded spot interposed between them, somewhat as in *Epeorus*; but in *Iron* this spot is isolated. Caudal setæ and mouth-parts similar to those of *Epeorus*.

Type. T. longimanus, sp. nov.

Distribution. North America, and (undescribed species in M'Lach. Mus.) on Irazu in Costa Rica.

Etymology. εἴρων, a dissembler.

The identification of the nymph rests upon specimens from Washington Territory in Mus. Comp. Zool. Cambridge, Mass., communicated by Dr. Hagen, representing subimago and nymph, viz.:—1 ♂ and 1 ♀ subim. registered "Wenas V., W. T., Pressy's 7. vii. 1882," and 3 nymphs registered "Klikitat V., W. T., Thorpe's 10. vii. 1882, S. Henshaw."

IRON LONGIMANUS, sp. nov. Plates XXIII. & XXIV. 44 (wings and legs), LXV. 2 (genitalia).

Epeorus (Colorado sp.), ! Etn., Ent. Mo. Mag. xviii. 26 (1881).—*E. longimanus*, ! *id.*, in the writing of Pl. XXIII. of this monograph (1883).

Iron longimanus, ! Etn., in the writing of Pl. XXIV. of this monograph (1883).

Imago (*dried*) ♂.—Notum either light yellowish ochre, or a light reddish-brown ochre. Dorsum of abdominal segments 2-9 tinged extensively with light brownish [sometimes light bistre, sometimes Vandyke], and in segments 2-7 exhibiting slightly depressed spaces translucent and deficient in colouring, viz.:—on each side of the segment an elongate ellipsoidal spot near the pleuræ, and a narrow space extending from spot to spot across the base; there is also, as frequently in *Ephemeridæ*, a small obovate or elongate pale spot on each side of the dark tract of the dorsal vessel; segments 9 and 10 are sometimes light-brown ochre, with a dark line down the middle: the pleuræ are of a

light colour, and the dark colouring of the terminal margin of each of the intermediate segments does not enter their hinder lateral angles, but a short bistre-brown streak runs in a curve from the said margin to the scar of the nymphal tracheal branchia on each side of every such segment very near the said angles. Venter of a light colour, translucent, apparently showing the light brownish ganglionic cords, and perhaps a small whitish spot on each side of them in each of the 2nd to 7th segments. Forceps-basis very salient in the middle behind. Setæ light warm sepia-brown. Femora and anterior tibia *in opaque view* translucent raw umber [in some lights rather yellower], the former each with a rounded black spot in the middle, and the latter bistre-brown at the insertion of the tarsus; fore tarsus dull light yellowish brown; hinder tibiæ and tarsi light yellowish brown or brownish yellow, with [in some positions of the specimens only] the terminal joint and the distal edges of the other tarsal joints light brownish. Wings vitreous; neuration of the fore-wing *in opaque view* light pitch-brown, but the great cross vein, the baseward extremity of the subcosta, and those of the nervures posterior to it are somewhat deficient in colour; the neuration of the hind wing also, as a whole, is of a similarly pale colour; *in transmitted light* the stronger nervures of the fore wing become light brownish amber; pterostigmatic cross veinlets simple. Length of body 9–10; wing 11; setæ, ♂ im. about 26–33 mm.

Hab. Colorado (M'Lach. Mus.); Manitou, Col. (Morrison, in Mus. Comp. Zool. Cambridge, Mass.).

Iron nitidus, sp. nov. Plate LXV. 3 (genitalia).

Imago (*dried*).— ♂. Notum light brown-ochre. Abdomen above and beneath in segments 2–7 very light bistre-brown (or in small examples very light yellowish ochre) somewhat translucent, with the joinings opaque, the dark colouring filling the hinder lateral angles of the segments; segments 8–10 light brown ochre, sometimes with the dorsal joinings light brown. Forceps-limbs light bistre. Setæ in some lights whitish yellow, tinged towards the roots with brownish; in other lights their predominant colour is light yellowish brown. Fore femur and tibia *in opaque view* light raw-umber brown, the latter bistre-brown at the insertion of the tarsus; fore tarsus whitish brown-ochre, with the joinings, the terminal joint and ungues slightly brownish; *in transmitted light* their predominant colours change to brownish amber and whitish amber respectively. Hinder legs *in opaque view* very pale yellowish, approaching whitish yellow-ochre, with the extreme bases of the tibiæ, the tarsal joinings, terminal joints, and ungues warm sepia-brown. Wings vitreous, strongly iridescent; the pterostigmatic region of the fore wing tinted with extremely light raw-umber; the remainder of the marginal and submarginal areas more faintly so tinted, and the other part of the wing almost imperceptibly so; neuration raw-umber brown; pterostigmatic cross veinlets, almost without exception, simple.

Variation.—In opaque view the ♂ fore tibia is lighter than the femur, and the tarsus is uniformly light bistre-brown: *in transmitted light* the tibia and tarsus are almost concolorous.

♀. Wing-membrane transparent, tinged universally with a light brownish yellow approaching the lightest shades of raw-umber. Fore tarsus lighter than the tibia, and with narrow brownish joinings. Notum in one specimen as dark as in the ♂; in another specimen it is of a much lighter brown-ochre. Length of body, ♂ 9–12, ♀ (*shrunken*) 9; wing, ♂ 11–14, ♀ 15; setæ, ♂ im. 28–36, ♀ im. 22 mm.

Hab. Mt. Hood, Oregon, and (Edwards) California (M'Lach. Mus.).

CINYGMA, gen. nov.

Illustrations.—Adult (details), Pl. LXV. 4, 5.

Adult.—Very closely related to *Iron*, the proportions of the tarsal joints of the intermediate legs being similar; but in the hind tarsus, joints 1–4 diminish successively in length, and there are differences in the proportions of the joints of the fore tarsus. First joint of the ♂ fore tarsus shorter than the second, and this a very little shorter than the third joint; first joint of the ♀ fore tarsus shorter than the second, but as long as the third joint; ungues each unlike the other. Penis-lobes similar to those of *Rhithrogena*. Fore leg of ♂ $\frac{9}{10}$ as long as the body; tarsus about $1\frac{1}{5}$ the length of the tibia, which is barely longer than the femur; the tarsal joints in the order of their shortening rank 3, 2, 4, 1, 5, and the first is about $\frac{2}{3}$ as long as the second joint. Fore leg of ♀ about $\frac{7}{10}$ as long as the body; tarsus about $\frac{3}{4}$ the length of the tibia, and this about as long as the femur; the tarsal joints in the order of their shortening rank 2, 1 equal to 3 and to 5, 4, and the first $\frac{6}{7}$ as long as the second. Hind tarsus of ♂ $\frac{1}{2}$ the length of the tibia, and this about $\frac{8}{9}$ that of the femur; its joints in the order of their shortening rank 5, 1, 2, 3, 4, the proximal three joints differing (if at all) successively in length by only small gradations. Ungues in every tarsus, each unlike the other. Hind wings of the usual form; the axillar region narrow. In the dried ♀ abdomen the relative lengths of the dorsal segments 2–10 may be formulated thus:—5, 6, 8, 10, 10, 10, 9, 7, 5; ventral lobe of the ninth segment retuse. Forceps-basis either produced into short lobes (as in *Epeorus*) for the support of the limbs, or else saliently toothed near the insertions of the limbs on each side of its posterior border; penis-lobes similar to those of *Rhithrogena*. Outer caudal setæ of ♂ thrice, of ♀ about twice, the length of the body. Median ocellus of ♀ somewhat isolated, and (though prominent) lower than the anterior border of the upper surface of the head; occipital margin almost even with the posterior orbits of the oculi. Pronotum of ♀ emarginate in the middle behind; the reflexed lateral lobes angular.

Subimago. Wings uniformly greyish or yellowish; their neuration opaque, but not bordered.

Type. C. integrum, sp. nov.

Distribution. North America.

Etymology. κίνυγμα, from the hovering habits of the flies.

Cinygma integrum, sp. nov. Plate LXV. 4 (genitalia).

Subimago (*dried*).—Wings transparent brownish grey, approaching light Cologne-earth; the hind wings lighter than the others, approaching whitish Cologne-earth grey: neuration inconspicuous, subopaque; the costa pale at the roots. Abdomen bistre-brown above, varied in segments 2–7 with very light brown-ochre; the darker colour borders the terminal margins of these segments broadly, excepting at the pleuræ, and in each of them is produced forwards to the base of the segment, both as a narrow stripe along the track of the dorsal vessel, and also as a broad longitudinal stripe through the midst of each side of the back; and conversely an oblong spot of the lighter colour extends from the base some distance along the pleuræ on each side of the back, and a narrower spot saliently curved externally reaches from the base some distance along each side of the dorsal vessel; venter unicolorous, very light brownish ochre.

Imago (*dried*), ♂.—Notum light pitch-, or Vandyke-brown. Abdomen in segments 2–7 translucent, light Vandyke-brown, opaque at the joinings above the pleuræ, and with three slightly darker longitudinal stripes from the hinder border of each of these segments, viz.:—one coincident with the track of the dorsal vessel, which is intersected lengthwise by a fine pale median line, and is sometimes only very faintly indicated, and another rather broader and darker stripe on each side of that, falling short of the base of the segment and vaguely delimited along its upper side; moreover the tracheæ are dark: in segments 8–10 the prevailing colour becomes modified either with light burnt-umber or with opaque burnt-sienna or brown-ochre, while the median stripe is posteriorly obliterated more or less in every segment, and in segments 8 and 9 the lateral stripes attain the base. Venter spotless, in segments 1–6 light Vandyke-brown, in the hinder segments light burnt-umber, approaching opaque burnt-sienna. Setæ very light bistre or whitish bistre-grey. Fore femur and tibia *in opaque view* light bistre-brown, with the insertion of the tarsus black, and with two broad indistinct obscure bands on the femur (one just before, and the other just beyond the middle); tarsus in some lights whitish brown-ochre, in other lights bistre-grey, or nearly concolorous with the tibia; *in transmitted light* the femur and tibia acquire a light brownish amber tint. Hinder legs lighter than the fore leg, the femora each with a single brown indistinct dark band beyond the middle, the tibiæ *in opaque view* whitish brown-ochre, and the tarsi either concolorous with the tibiæ or in some lights greyish or light brownish: *in transmitted light* the femora become light yellowish amber, and the tibiæ whitish amber-coloured. Wings vitreous; the pterostigmatic region of the fore wing (tinged, like the membrane just at the roots, with extremely light bistre-grey) contains evenly anastomosing cross veinlets: neuration pitch-brown.

♀. Very similar to ♂; but the notum is of a light yellowish brown approaching light brown-ochre, the setæ whitish brown-ochre, the femora of some examples more strongly coloured than in ♂, and the tibiæ *in opaque view* dull light brown-ochre. Length of body, ♂ 11, ♀ shrunken; wing, ♂ 12, ♀ 10–13; setæ, ♂ im. upwards of 25, ♀ im. 15–20 mm.

Hab. Washington Territory, and Mt. Hood, Oregon (M'Lach. Mus.).

Cinygma par, sp. nov. Plate LXV. 5 (genitalia).

Imago (*dried*), ♂.—Notum light pitch-brown, sometimes approaching light luteo-piceous anteriorly at the sides. Dorsum of the abdomen Vandyke-brown and opaque in segments 8–10; the other segments for the most part are lighter and somewhat translucent, the dark colouring at their tips being shaded off anteriorly and encroached upon by dirty-whitish subtransparent spaces, viz.:—a large space on each side of the back in front, a narrow strip extending across from the one space to the other along the anterior margin of the segment, and three longitudinal linear streaks proceeding from the base nearly to the terminal border of the segment, of which the intermediate (coincident with the course of the dorsal vessel) and the others are narrowly edged with dark colouring: in the large subtransparent spaces referred to the tracheæ are visible, and in some lights appear slightly brownish; the hinder angles of the pleuræ are pale. Venter in segments 3–7 translucent, with conspicuous nervous ganglia of a light warm sepia-brown; the hinder segments opaque, and of a very light brownish ochre. Setæ light warm sepia-brown. Legs *in opaque view* bistre-brown, the base of the fore femur and the fore trochanter rather lighter, the insertion of the fore tarsus slightly darker: *in transmitted light* their predominant colour is brown-amber or golden brown. Wings vitreous, tinted with light bistre-grey throughout, but with a stronger tint than elsewhere in the pterostigmatic region of the fore wing and at the wing-roots: neuration *in opaque view* bistre-brown, changing in transmitted light to raw-umber brown: the cross veinlets of the pterostigmatic space in the fore wing are mostly simple and seldom anastomosed at all, and then only irregularly and very sparsely. Length of body, ♂ 8; wing 9–10; setæ, ♂ im. 18–20 mm.

Hab. Arizona (M'Lach. Mus.).

Cinygma mimus, sp. nov.

Imago (*dried*), ♂.—Very similar in aspect to the European *Rhithrogena semicolorata*. Notum either light raw-umber or light chestnut-brown. Abdomen discoloured: in opaque view segments 7–10 are in some specimens of a light brownish colour approaching brown-ochre, and the remaining segments of a light purplish brown; but in other specimens the prevailing colour is more nearly madder-brown: segments 2–7 are each of them colourless and transparent at the extreme base, and the colourless spaces, narrow in the middle, are enlarged a little by the pleuræ, presenting thereabouts a small rounded expansion on each side bounded posteriorly by the anterior tracheæ of the segment: the arrangement of the ventral colouring resembles that of the dorsum. Setæ light raw-umber brown. Legs light yellowish brown, approaching raw-umber or dull bronze-brown in some lights, with the insertion of the fore tarsus and the ungues of that foot light pitch-brown, and the hinder tibiæ and tarsi rather lighter and yellower than the femora; in transmitted light the femora and fore tibiæ become light brownish amber, and the remainder yellowish amber. Wings vitreous with raw-umber brown neuration varying in intensity with change of light: but the subcosta and radius to the middle, and the basal extremities of the hinder longitudinal nervures of the fore wing, and the

costa and the bases of the remaining nervures of the hind wing appear in most positions of a light raw-umber or yellowish brown, and the rest of the neuration intense raw-umber approaching pitch-brown: the wing-membrane is faintly tinted with light raw-umber throughout; but the tint is chiefly noticeable in the hind wing and the basal half of the fore wing, as in the *Rhithrogena* referred to above. Length of body 9; wing 10; setæ, ♂ im. about 20 mm.

Hab. Colorado (M'Lach. Mus.); Manitou, Col. (Mus. Comp. Zool. Cambridge, Mass.).

CINYGMA GEMINATUM, sp. nov.

Subimago (*dried*).—Very similar in aspect to *Heptagenia sulphurea*. Wings and neuration in ♀ light yellowish ochre throughout; in ♂ the membrane is rather of a yellowish grey, but the neuration is light yellowish ochre, though less strongly coloured than in the other sex. Setæ concolorous with the wings. Notum yellow-ochre varied with lighter. Abdomen faded. Fore femur in ♂ light brownish ochre, in ♀ Mars yellow: tibiæ and tarsi all whitish yellow-ochre, with the tarsal joinings and the joining of the tibia with the tarsus light brownish; in transmitted light the fore femur becomes brownish amber, the hinder femora and fore tibia light yellowish amber, and the tarsi and hinder tibiæ whitish amber.

Imago (*dried*), ♀.—Almost indistinguishable without inspection from *Heptagenia sulphurea*, ♀ im., and even when closely compared together the differences in colour between the two species are trivial and few. *C. geminatum* has the vertex of the head suffused with light reddish brown, no black spots near the eyes either on the vertex or on the face, nor any at the bases of the coxæ; setæ uniformly whitish; wing-neuration for the most part piceous or bistre-brown instead of black, the stronger longitudinal nervures amber-coloured towards the base; wing-membrane vitreous, uniformly tinted in the faintest degree with pale yellowish. Length of wing, ♂ 8–9·5, ♀ 9–12; setæ, ♀ im. [the smallest specimen] about 18 mm.

Hab. Washington Territory and (Lord Walsingham) California (in M'Lach. Mus.); Arkansas Cañon, Col. (P. R. Uhler, in Mus. Comp. Zool. Cambridge, Mass.). This species and *Rhithrogena elegantula* are almost exactly alike in colour.

RHITHROGENA, Etn., 1881

Illustrations. Adult (details) Pls. XXIII. and XXIV. 43, see also citation of Palmén (1884) under *Rh. semicolorata*; (whole figures) refer to citations of Stephens (1835) and Pictet (1843–5) under the same, and of the latter under *Rh. semitincta*. *Nymph*, Pl. LIV.; see also citation of Pictet (1843–5) ‡ *Baëtis* ‡ *lateralis* under *Rh. aurantiaca*.

Adult.—First joint of the hind tarsus equal to the second and a little longer than the third joint; first joint of the intermediate tarsus a little shorter than the second, but equal to the third joint; first joint of the ♂ fore tarsus much shorter than the second, and this equal or subequal to the third joint; first joint of the ♀ fore tarsus much (about $\frac{1}{2}$) shorter than the second, which is longer than the third joint; ungues mutually

dissimilar. Penis-lobes narrow, often extremely so when dried and apt to shrink to mere peg-like projections (compare Pl. XXIV. 43[3]).—Fore leg of ♂ $1\frac{1}{8}$–$1\frac{1}{5}$ the length of the body: tarsus about $1\frac{2}{3}$ as long as the tibia, and this $1\frac{1}{4}$ the length of the femur; the joints in order of their shortening rank 3 subequal to 2, 4, 5, 1, and the first is about $\frac{1}{5}$ as long as the second joint. Fore leg of ♀ about as long as the body: tarsus little more than $\frac{1}{2}$ the length of the tibia, and this nearly $1\frac{1}{4}$ that of the femur: the joints, in the order of their shortening, rank variously in different species, the second or the fifth being the longest and sometimes of the same length, the third usually shorter (rarely as long as the fifth), the first usually equal in length to the fourth (rarely a little longer) and about $\frac{1}{2}$ as long as the second joint. Hind tarsus ♂ about $\frac{3}{7}$ the length of the tibia, which is little shorter than the femur; its joints, in order of their shortening, rank 5, 1 equal to 2, 3, 4: those of the intermediate tarsus rank 5, 2, 1 equal to 3, 4. Ungues each unlike the other in every tarsus. Hind wings of the usual form; axillary region narrow. The relative lengths of the dorsal segments of the dried ♀ abdomen may be formulated thus:—5, 9, 12, 14, 13, 10, 9, 5, 4; ventral lobe of the ninth segment either obtusely rounded or slightly retuse at the tip. Forceps-basis of the ♂ usually concave in the middle behind, rarely saliently curved. Penis-lobes divergent from each other during life, often contiguous when dried: inferior stimuli well developed, usually closely appressed to the lobes: apertures of the seminal ducts terminal. Outer caudal setæ of ♂ usually 2–$2\frac{1}{2}$, seldom 3 times, the length of the body, those of ♀ about twice its length. Median ocellus of ♀ prominent, contiguous with the anterior border of the upper surface of the head: the occipital border very slightly (if at all) convex in the middle, almost even with the posterior orbits of the oculi. Pronotum of ♀ somewhat cordately excised behind; the lateral lobes not extensively reflexed.

Subimago.—Wings tinted with grey [yellowish in a single species from Arizona]: neuration not conspicuously darker than the membrane, nor bordered with pigment especially. The ordinary length of this period is 24–36 hours: the insect during repose stands upon all its feet with wings erect and setæ divergent.

Nymph.—In the pose of the laminæ of the abdominal tracheal branchiæ—the foremost pair attaining mutual contact at the tips of the laminæ beneath the metasternum, the intermediate pairs reclining outwards (figs. 1, 2) when not deflected out of sight (fig. 3), and the hindermost pair transversed lengthwise by an eccentric open fold and brought together beneath the penultimate segment—this nymph resembles that of *Iron*. But the laminæ are slightly different in form from those of that nymph: the foremost are very large, transverse, oblong, and curved: the other laminæ exhibit successive gradations in form from subrotund-oblong, through oblong-obovate and obovate to oval: again, although their inferior margins are ciliate they are not thickened. Moreover the fasciculated fibrils are longer in proportion to the laminæ and more lax than in *Iron*; and the branchial tracheæ are invisible, or become obliterated after death. Median caudal setæ subequal to the others, nearly as long as the body, minutely plumose for some distance beyond its basal $\frac{1}{3}$: the other setæ ciliated correspondingly on their inner sides. Pronotum transverse, very short, undilated, and either curved or nearly straight at the sides: its posterior margin well defined, saliently rounded off on each side of a

median sinus. Fangs of the mandibles very unequal and of peculiar construction: *viewed from beneath* (Pl. LIV. 8 and 9) *without compression*, the exterior and much the larger fang, which is set obliquely in relation to the stipes, appears falcate, sharply truncate at its outer base, just opposite the very rudimentary interior fang, and serrulate for some distance before the tip along its outer edge: *viewed from above under pressure* (Pl. LXV. 6) each fang opens out into a concave expansion; the exterior becomes acutely subovate triangular, truncate at the inner basal angle where it joins the crown of the mandible, and displays fine serrulations along both its lateral margins, while its base is pectinate or ciliated and inflexed; the interior fang [or ? endopodite] partly contained in the concavity of the outer fang, is oblong-cochleariform or like an oblong scoop, slenderly serrulate at its terminal border, finely and densely pectinate along the upturned edge subtended by the concavity of the outer fang, and sparsely ciliate along the opposite edge. The hairs composing the tuft near the inner bases of the fangs appear unilaterally plumose when highly magnified in a favourable light. Lacinia of maxilla 1. beset along the edge of the crown with appressed pectinate teeth: proximal joint of the palpus broadly dilated behind: terminal joint stoutly clavate, oblique at the extremity, and densely scabrid externally from near the base to the acute point. Median lobe of the tongue (as in *Epeorus*) quadrilateral, broader than the paraglossæ, which are narrow and dilated in the middle. Femora marked on the coloured side each with a conspicuous isolated dark spot, in or about the middle, and sometimes clouded with grey between that and the tip.

NORTH AMERICAN SPECIES.

Rhithrogena jejuna (renamed).

‡ *Baetis* ‖ *fusca*, ! Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 568 (1853); Hag., Smithson. Miscell. Coll. (1861) Synop. Neuropt. N. Am. 45.

Heptagenia fusca, ! Etn., Trans. Ent. Soc. London (1871) 138, pl. vi. 13–13 *b* [detail].

Imago (dried).— ♂. Thorax dull rufo-piceous above. Abdomen in segments 2–5 translucent burnt-umber brown, with the apical borders of the dorsal segments darker. Forceps bistre-brown. Legs bistre-brown; the femora each with a black longitudinal streak tapering at both ends and commencing at a short distance from the base; the apical lobe of the fore tibia pitch-black. Wings vitreous, the membrane tinted with very light bistre-grey, scarcely darker or greyish-tinted in the pterostigmatic space; neuration pitch-brown; the marginal area of the fore wing contains about 3 cross veinlets before and 19 beyond the bulla; many of these in the pterostigmatic region divide irregularly and anastomose with one another.

♀. Abdomen bistre-brown, the distal borders of segments 3–8 rather broadly margined with pitch-black. In the marginal area of the fore wing are about 6 cross veinlets before, and 21 beyond the bulla. Length of body 6–7, wing 9–10 mm., in both sexes.

Hab. St. Martin's Falls, Albany River, Hudson's Bay (Brit. Mus.). The specific name of this species should be rendered "uninteresting".

RHITHROGENA MANIFESTA (renamed).

‡ *Baëtis* ‖ *debilis*, ! Walsh, Proc. Acad. Nat. Sc. Philad. (1862) 371; Hag., Proc. Ent. Soc. Philad. ii. 170 (1863) [nec. ‡ *B. debilis* ! Walk. 1853; neque *B.* ‖ *debilis* ! Walk. (*Cl. debilis*) 1860].

‡ *Siphlurus debilis*, Etn., Trans. Ent. Soc. London (1871) 130.

Subimago.—Wings fumose, with fuscous neuration. Setæ cloudy at the tips. Fore tarsi fuscous.

Imago (*living*), ♂.—Eyes brown above, fuscous in their lowest ¼. Notum generally piceous. Dorsum of abdomen ferruginous, with the distal ⅓–½ of each segment more or less piceous. Setæ uniformly whitish; forceps pale. Legs pale greenish; the femora with a narrow median band [? thin longitudinal streak] and generally the knee fuscous; the tip of the fore tibia, the tips of the tarsi, and the incisures of the fore tarsus fuscous. Wings hyaline; neuration pale greenish hyaline, excepting the basal ⅓ of the costa, subcosta, and radius, and occasionally their tips, which are fuscous in the fore wing.

♀. Paler than ♂; thorax almost yellow. Abdomen ferruginous, usually darker at the tip of every joint. Wing-veins dusky along the costa and at the tip of the fore wing, gradually becoming hyaline as they approach the anal angle. Length of body 4–7; wing 5–7; setæ, ♂ im. 13–14, subim. about 5, ♀ im. 8–11·5 mm.

Hab. Rock Island, Ill. [after Walsh]. Why Walsh should have supposed this insect to be more nearly related to *Siphlurus* than to *Heptagenia* is inexplicable.

RHITHROGENA HAGENI (renamed). Plate XXIV. 43 *c* (penis dried).

Heptagenia ‖ *brunnea*, ! Hag., Ann. Rep. U. S. Geolog. & Geograph. Survey of the Terr. 1873, part iii. Zool. 581 (1875) [♂ im. only].

Imago (*dried*), ♂.—Thorax above bright-brown ochreous, the peak of the mesonotum flavescent, a line adjacent to the tegulæ and a streak below it in front of these in a depression brown-black. Abdomen above pitch-brown, the tips of the segments darker; venter rufescenti-lutescent, spotless; setæ sepia-brown, with most of the joinings opaque. Forceps pitch-brown. Wings vitreous, the fore wings almost imperceptibly tinted with light sepia-grey in the pterostigmatic space; their marginal area contains 4 or 5 cross veinlets before the bulla, then 5–7 simple, followed by 11–14 irregular cross veinlets anastomosing with one another nearer the costa than the subcosta; neuration pitch-brown, paler just at the wing-roots. Fore legs fuscous, the tibiæ and tarsi piceo-fuscous; hinder legs luteo-fuscescent, their tarsi slightly browner or warm sepia; every femur in its proximal half is marked with a longitudinal brown-black streak tapering at both ends. Length of body 10, wing 13 mm.

Hab. Nevada, Truckee in the Sierra Nevada, June 10 (G. R. Crotch).

RHITHROGENA ELEGANTULA, sp. nov.

Subimago (*dried*).—Wings as in *Heptagenia sulphurea*, extremely pale yellowish ochre, with concolorous neuration. Setæ dull whitish, with the joinings narrowly reddish. Tarsi slightly tinged with brownish, approaching bistre-brown; the joinings seem opaque only in transmitted light. The femoral bands are faintly defined.

Imago (*dried*), ♂.—Similar in general aspect to *Heptagenia sulphurea*. Notum very pale yellowish ochre, traversed lengthwise by a median reddish brown-ochre stripe approaching raw-umber. Dorsum of the abdomen in segments 2–5 and the base of segment 6 transparent whitish shaded with greenish bistre-grey, with the joinings of the segments narrowly subopaque and of a darker shade of the same grey; the remainder of segment 6 and the hinder dorsal segments nearly concolorous with the notum. Venter uniformly pale yellowish ochre. Fore femur in opaque view light bronze-brown approaching raw-umber, darker and light reddish-brown just at the knee, and very indistinctly banded in the middle with the same colour; tibia in some positions concolorous with the femur, but in other positions both it and the tarsus appear lighter, and the tip of the tibia, the last joint and joinings of the tarsus, and the ungues are rufo-piceous or of a dull reddish tint: in transmitted light the prevailing colour of the leg is light yellowish amber, and the markings are reddish amber. Hinder legs rather similar in colour and markings to the fore leg, but lighter, and without any trace of the median femoral band or any spot at the tip of the tibia. Wings vitreous; the fore wing tinted slightly with light greenish- or bistre-grey in the pterostigmatic region, and more faintly still in the remainder of the marginal and submarginal areas: neuration in opaque view piceous or black, excepting the subcosta and radius in the basal half of the fore wing, which are yellow-amber; in some positions the longitudinal neuration appears pitch-brown, and the cross veinlets black: in transmitted light the greater part of the neuration appears brown-amber: the great cross vein of the fore wing is thickened posteriorly and piceous.

♀. Light yellowish ochreous like *Heptagenia sulphurea*. Head marked on each side with a small triangular black spot at the anterior lower angle of the oculi, and with a reddish brown mark close to the orbit in the midst of the vertex. The rugæ at the sides of the thorax between the wing-roots and the legs are edged with black, as in the ♂. Legs rather stronger in colour than in the other sex, the femora being transparent greenish grey and having the median band, though faint, better defined. Length of body (shrunken) 6; wing, ♂ 9, ♀ 10 mm. Setæ defective.

Hab. Arkansas Cañon, Colorado (P. R. Uhler, in Mus. Comp. Zool. Cambridge, Mass.); Arizona (M'Lach. Mus.).

Rhithrogena vitrea, Walker.

‡ *Palingenia vitrea*, ! Walk., List of Neurop. Ins. in Brit. Mus. part iii. 555 (1853).
Heptagenia vitrea, ! Etn., Trans. Ent. Soc. London (1871) 143, note.

Subimago (*dried*), ♀.—Wing-membrane very light smoky grey, the neuration extremely light brown-ochraceous. Body light brown-ochreous; the legs nearly of the same colour, each femur banded in the middle with black-grey, and light brownish at the knee; fore tarsus light warm sepia-brown. In the marginal area of the fore wing are 6–7 cross veinlets before the bulla, and 15–17, simple and straight, beyond it. Length of body 6; wing 6 mm.

Hab. St. Martin's Falls, Albany River, Hudson's Bay (Brit. Mus.).

EUROPEAN SPECIES.

Rhithrogena borealis, Etn.

Heptagenia borealis, ! Etn., Trans. Ent. Soc. London (1871) 137, pl. vi. 11 [detail]; Palmén, Paar. Ausf.-Gänge d. Geschl. Org. b. Insect. 852 (1884) [anatom.].

Imago (*dried*), ♂.—Notum piceous. Abdomen ochraceous, translucent, with the tips of the anterior segments, in addition to the last three or four segments, light fuscous above. Setæ fawn-grey with fuscous joinings. Legs light fuscous. Wings vitreous; the longitudinal nervures light fuscous. Length of body or wing, ♂ 10 mm.

Hab. Finmark, between Koutokæino and Karesuando (Walker MS., in Dale Mus.).

Rhithrogena nivata, Etn.

Heptagenia nivata, ! Etn., Trans. Ent. Soc. London (1871) 137, pl. vi. 10 [genitalia].

Subimago (*living*).—Fore wings dark cinereous; hind wings lighter. Hinder legs olivaceous, with dusky tarsi; fore legs darker. Setæ dull black.

Imago (*living*), ♂.—Eyes sooty black above, tinged slightly with olivaceous below. Notum jet-black. Dorsum of the abdomen fuscous, rather paler by the joinings; venter olivaceous. Setæ dusky, with the joinings narrowly dark. Fore femur olive-black, the tibia and tarsus black; hinder femora olivaceous, the tibiæ dull whitish-olive-grey or cretaceous, the tarsi tinted with olive. Wings uniformly vitreous; neuration olive-grey.

♀. Fore tibia and tarsus dusky, very dark; hinder tibiæ cretaceous, the tarsi dusky, with pale ungues. Venter olivaceous, with rather darker spots under the ganglia: lobe of the 9th segment slightly emarginate. Length of body 11; wing, ♂ 12, ♀ 17; setæ, ♂ im. 27, subim. 8, ♀ im. 12–15 mm.

Hab. The Barberine in the Val de Trient (about 3700 ft.) and Lac de Combal (5774 ft.).

Rhithrogena alpestris, sp. nov. Plate XXIV. 43 *a* [genitalia, ♂].

Rhithrogena ‡ *semitincta*, Etn. MS. in the writing of Pl. xxiv.

Subimago (*dried*).—Wings very light brownish grey (Cologne Earth grey) with opaque longitudinal neuration; nearly concolorous with dried examples of *Rh. semicolorata*.

Imago (*living*), ♂.—Eyes fuscescent, or greenish bistre-brown above, traversed by a broad black band, and bluish grey below that band. Notum fusco-piceous. Abdomen above suffusco-piceous, pale by the joinings at the extreme bases of the intermediate segments; venter fuligineo-fuscous, with pale joinings, tinged in the penultimate segment with burnt-sienna (rubiginous); forceps dusky. Setæ slightly dusky, with subpiceous joinings towards the roots. Fore leg blackish, with the end of the femur and tibia black; hinder legs very light greenish grey, with the tip of the femur fuscous above, and the tarsi dusky, with the terminal margins of the short joints black; trochanters terminated each by a black point; coxæ suffuscous; mesosternum piceous. Wings uniformly vitreous, with subpiceous neuration: tegulæ light yellowish.

♀. Eyes fusco-olivaceous traversed by a moveable black band. Epistoma greyish; vertex of head piceous, varied with yellowish fuscous. Abdomen lighter than in the ♂; segments 2–7, each with a pale dot on each side of the median dorsal line nearly in the

middle: egg-valve darker than the neighbouring parts; lobe of the 9th ventral segment entire. Legs of a greener tint than in the ♂; a dark longitudinal streak nearly in the middle of the inner side of the fore femur; the hinder tibiæ whitish basewards, but distally, like the tarsi, dusky. Pterostigmatic region very faintly tinted with dusky; tegulæ more or less yellowish. Length of body 8·5; wing, ♂ 10, ♀ 11; setæ, ♂ im. 20-25, ♀ im. 17 mm.

Hab. Switzerland, Savoy, and North Italy; July to September. Alpbach, Meyringen (1 subim. 15th August, M'Lach.); common near the Chalets de Pas, Champéry (5760 ft., 5 P.M., 20th August, water 51° F.); very common in the vicinage of Charbonnière, about the head-waters of the Dranse de Biot (4300–4800 ft., 4–5 P.M., 2nd Sept., water 62° to 48° F.); also singly by the Oglio in the Val Mazza above Ponte di Legno (5800 ft., 4.45 P.M., 29th July, water 49° to 56° F.).

RHITHROGENA HYBRIDA, sp. nov.

Imago (*dried*), ♂.—Notum black. Dorsum of the abdomen pitch-brown. Setæ light warm sepia-brown with slightly opaque joinings. Fore leg pitch-brown or intense bistre-brown: hinder femora *in opaque view* uniformly of a reddish brown, the tibiæ lighter and of a rather yellower brown in some postures, and the tarsi slightly greyish; no femoral markings. The colouring of the wings in its distribution conforms to that of Variation 1. of *Rh. semicolorata*, but is of a duller hue, being light bistre-brown instead of raw-umber. Wing-neuration, in opaque view, entirely pitch-brown, excepting that the sector (4), cubitus, brachial, and anal (8) nervures of the fore wing are deficient in colour at the extreme roots where they meet the raised fold in the membrane. Length of wing 9–10 mm.

Hab. Savoy, in the neighbourhood of Samoëns; common about the head-waters of the Dranse de Biot, near Charbonnière (4780 ft., 10 A.M., 12th August); also near the Chalets de Jouplane (5100 ft., 9.30 A.M., 29th August, water 52° F.). Easily mistaken for the following species; but the absence of femoral markings, and the uniformly dark colour of the subcosta and radius of the fore wing seem to necessitate their separation.

RHITHROGENA SEMICOLORATA, Curtis. Plates XXIII. 43 [& virtually 44] (wings), XXIV. 43 (legs), & 43 [1-3] (penis). Nymph Plate LIV. 3, 4.

? [*Ephemera*] or *E. stigma* [Zsch. Mus. Lesk. i. 150, no. 20 (1789)]; Gmel. Linn. Syst. Nat. ed. xiii. i. pars v. 2630 (1790); Ol., Encyc. Méth. vi. 422 (1791).—? *E. fuscula*, Schrank, Fn. Boica, ii. 199 (1798).

‡ *Baëtis semicolorata*, Curt., Lond. & Edinb. Philos. Mag. ser. 3 (1834) 121; ! Steph., Ill. Brit. Ent. vi. 64, pl. xxix. 2 (1835); Pict. Hist. Nat. Névropt. ii. Ephém. 178, pl. xxii. 4–9 (1843–5); Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 577 (1853); Hag., Ent. Ann. (1863) 26.—‡ *B. semitincta*, Pict., Hist. Nat. Névropt. ii. Ephém. 180, pl. xxii. 1–3 (1843–5); Walk., List &c. part iii. 558 (1853); Brauer, Neuropt. Austr. 26 (1857); Ausser., Ann. d. Soc. Natur. Modena, An. iv. 133 (1869); Etn., Trans. Ent. Soc. London (1871) 36, note.

Heptagenia semicolorata, ! Etn. Trans. Ent. Soc. London (1871) 136, pl. vi. 9 [detail]; Hag. & Etn., *op. cit.* (1873) 403; Meyer-Dür, Bull. Soc. Ent. Suisse iv. 311 (1874); Rostock, Jahresb. d. Ver. f.

Naturk. Zwickau, 1877, p. 89 (1878) ; Palmén, Paar. Ausf.-Gänge d. Geschl. Org. b. Insect. S. 44 & 52, taf. ii. 30 (1884) [detail & anatom.].—*H. semitincta,* Meyer-Dür, Bull. Soc. Ent. Suisse, iv. 312 (1874).

Rhithrogena [type] *semicolorata,* ! Etn., Ent. Mo. Mag. xviii. 23 (1881); *nec Rh. semitincta,* ! *id.,* in the writing of Pl. xxiv. 43 *a* of this work.

Subimago (*living*).—Fore wings very light grey; hind wings paler. Legs greenish-, or brownish-grey, with a small elongated spot in the middle of the femur, and with the tarsus brown-black or greenish-black. Setæ very pale grey. ♂. Oculi dark olivaceous, crossed by a transverse black line. (*Dried.*)—Fore wings very light brownish-grey; hind wings dull greyish white: femoral spots often indistinct or lost.

Imago (*living*), ♂.—Genital stimuli narrowly ligulate, closely appressed to the lobes of the penis, and acutely bi- or tri-denticulate at the tips. Eyes intense raw-umber or olive-brown above, and either black or pitch-brown below, and sometimes with a bluish grey or greenish grey edging to this darker surface, ocelli piceous. Notum light bistre-brown or pale fuscous, varied on the metanotum with pitch-brown, and sometimes with a small yellowish spot near the peak. Dorsum of the abdomen light bistre-brown or greenish grey, sometimes tinted in segments 8–10 with brown-ochre or raw-umber, and with the joinings of the intermediate segments whitish: venter dull light sepia- or olive-grey in segments 2–7 or 8, and either somewhat dull rubiginose (medium burnt-sienna) or ochreous in the last two or three segments. Setæ light sepia-brown, or dusky, or brown-black. Forceps-basis dull, either rubiginose or greenish grey: the limbs blackish, with the last two joints sepia-grey. Femora light greenish grey, each with a submedian triangular longitudinal black streak, which is acute inwards and acuminate outwards in the hinder legs, but more rounded in the fore leg: fore tibia and tarsus either sepia-grey or dark olive-grey; hinder tibiæ and tarsi sometimes of a lighter sepia-, or greenish-grey than the fore legs, and sometimes of a yellower tint, with the extreme distal edges of the short tarsal joints black, and with the ungues slightly rufescent or greyish. *When dried* the femora in opaque view approach raw-umber brown in their general hue; in transmitted light the femora become strongly yellowish amber, and the hinder tibiæ pale yellowish amber: the femoral streaks sometimes disappear. Wings vitreous, varying considerably in the tint and extent of their coloration.

In the typical *semicolorata*, Curt. [the *semitincta* of Pictet] the membrane in the basal half of the fore wing, and throughout the hind wing, is only faintly tinted with dull rusty yellow: *in opaque view* the neuration of both wings appears pitch-black, excepting the extreme roots of the costa, sector (4), cubitus, præbrachial, pobrachial, and anal (8), the great cross vein, and the part between the roots and the bulla of the subcosta and radius (3) of the fore wing, which are subtestaceous or rusty yellow; *in transmitted light* the whole of the neuration becomes in some positions light brownish, but in most positions light brownish amber.

Variation 1 [the *semicolorata* of Pictet, not of Curt.].—The coloration of the fore wing extends to the tip in the marginal and submarginal areas, and in the disk reaches from the wing-roots to a little beyond the junction of the sector (4) and the fourth sectorial intercalar nervure, the fork of the præbrachial (6), and the anal angle, forming

a distinctly defined cloud of deeper tint than the colouring of the typical specimens—in fact, sometimes a medium raw-umber brown cloud. Legs darker than in the typical race: *when dried* the fore femur becomes raw-umber brown, and the tibia and tarsus light pitch-brown, with the insertion of the latter dark; femoral streak distinct.

Variation 2.—The whole of the membrane of the fore wing is tinted with dull rusty yellow, and the colouring in the basal half is scarcely, if at all, darker than in the remainder, although, when the wings are erect, it may apparently be so where the hind wings underlie the others. Notum brown-ochreous. Legs lighter than in the typical race; femoral streaks distinct but rather small.

♀ (*living*).—Eyes olive-black. Dorsum of the abdomen intermediate in tint between yellow-ochre and raw-sienna, very pale by the joinings; venter very light Mars-yellow; lobe of the ninth ventral segment emarginate. Legs golden-brown or brown-amber; the fore tibia and tarsus, the hinder tarsi, and the bases of the hinder tibiæ tinged with olive-grey; the femoral spots or streaks, the femoral tracheæ, and the points of the trochanters black. Wings vitreous, colourless or almost colourless: *in opaque view* the stronger of the longitudinal nervures appear to be subtestaceous or rusty yellow, the finer nervures piceous, and the cross veinlets black; *in transmitted light* all of the neuration appears subtestaceous.

Variation [the *semicolorata* of Pict., not of Curt.].—The colour of the wings resembles that of Variation 2 of the other sex.

Length of body 7–11; wing 7–12 [usually 10–12]; setæ [of the larger specimens], ♂ im. 23–28, subim. 8–9, ♀ im. 14, subim. 10 mm.

Hab. Europe, from Norway (Wallengren) southwards to the Alps and Pyrenees. The typical race is common in Great Britain from June to September, frequenting trout-streams and the swift parts of rivers ranging in temperature during the summer from about 51° to 58° F. In Cumberland, on Cross Fell, it ascends to about 1500 feet. The same race occurs on the continent in Belgium, France, Saxony, Switzerland, Bavaria, northern Italy, and (Zeller, in M'Lach. Mus.) Carinthia, *e. g.* at the following localities:—the stream at Versoix in June (Pict.) [upwards of 1250 ft., water 58° F. in the afternoon of August 24th]; Morillon near Samoëns [2200 ft., water 50° F., 4–6 P.M. August 30th]; between Partenkirchen and Mittenwald in Bavaria; in the Ortler district, both in the Val Furva above Sta Caterina [6300 ft., water 59° F., July 28th], and in the Val Mazza near Ponte di Legno [5800 ft., water in the Oglio 49° F., but 56° F. in a tributary torrent at the same place, July 29th, in the afternoon]; along the Néez, above the Pont d'Oly, near Jurançon, Pau [about 600 ft.]; on the road to the Col des Tontes from Eaux Bonnes [3220 ft.]; and at the outlet of the Lac d'Aious [5945 ft.].

Variation 1 is represented in M'Lach. Mus. by specimens from Autun, Gex (Ain), and Neuchatel. According to Pictet it is common in the neighbourhood of Geneva, at streams, and is wont to appear in large numbers before rain or thunder-storms in summer. Variation 2, in the same collection, is ticketed Carinthia, May 27th (Zeller). Pictet makes no mention of the femoral markings.

RHITHROGENA AURANTIACA, Burmeister.

‡ *Baëtis aurantiaca*, Burm., Handb. d. Ent. Bd. ii. Abth. ii. 801 (1839); Pict., Hist. Nat. Névropt. ii. Ephém. 191 (1843–5); Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 560 (1853); Etn., Trans. Ent. Soc. London (1871), 148 [note to Synon. of *Heptagenia iridana*].—? *B.* ‡ *lateralis*, Pict., *op. cit.*, pl. xxi. i. [nymph] (1843–5).

Heptagenia aurantiaca, Meyer-Dür, Bull. Soc. Ent. Suisse, iv. 315 (1874); ! Rostock, Jahresb. d. Ver. f. Naturk. Zwickau, 1877, p. 91 (1878).

Rhithrogena [nymph], ! Etn., Ent. Mo. Mag. xviii. 24 (1881).

Subimago (*living*), ♀.—Wings usually griseous, seldom light sepia-grey, the hind wings scarcely, if at all, lighter than the fore wings; wing-roots dull pale brownish-yellow marked with a brown spot, the great cross vein similarly brownish; neuration a little darker. Setæ griseous. Oculi subolivaceous or cæsious, with a black transverse line and a black moveable spot; orbits of ocelli black; a black line or triangular spot extends from the base of the antenna almost to the orbit of the ocellus, and the facial carina has sometimes a small black spot upon it. Pronotum pale, sometimes edged with black; a faint fuscous blotch at the front border of the mesonotum; tegulæ, a stripe in continuation with them, the two longitudinal sutures of the mesonotum nearest to the tegulæ, and one or two lines on the pleuræ in advance of the intermediate coxæ, subpiceous or nigro-piceous; a black spot on the foremost stigma; a dark or black dot or dash upon the outer proximal joining of the intermediate coxa, or in front of it, and a spot upon the meso-pectus behind the coxa (or else a fine subpiceous line between the coxa and the mesopectus in its stead); a black spot at the base of the hind coxa in front, and another beneath at its tip; trochanters black-pointed. Fore femur greenish grey, black at the extreme edge of the knee above, and marked nearly in the middle with a small black V-shaped or triangular spot; fore tibia blackish grey, black at the knee; fore tarsus and ungues black. Hinder legs lighter, but correspondingly marked.

Imago (*living*), ♂.—Oculi commonly intense burnt-umber brown above and greenish grey beneath, divided either by a black transverse line or by a pale space edged with black; sometimes the upper portion is fusco-olivaceous, and the lower cæsious or cærulescenti-griseous; in twilight, or by candle-light, the upper part appears greenish black. Occiput black; face pale, marked, as in subimago, with fuscous or piceous. Thorax above varying from brownish yellow-green (pistazinous), or fuscous, or pitch-brown, or luteo-piceous, to pitch-black [changing to luteous or luteo-piceous in dried examples]; the metanotum black or piceous; sternum concolorous with the mesonotum. Markings of the pleuræ and pectus, coxæ, and femora very similar to the same in subimago: ground-colour of the legs:—fore femur at first pistazinous changing to piceous; tibia and tarsus in some lights darker, in others the tarsus is paler than the tibia, and its insertion is black: hinder femora at first almost greenish white, changing to light olivaceous; tibiæ paler, sometimes piceous at the tip; tarsi smoky, or blackish grey, darker than the fore tarsus, with the incisures very narrowly black. Wings vitreous; neuration either fuscescent or colourless, but the subcostal bulla piceous; cross veinlets in the marginal area of the fore wing usually quite simple, 2–6 (3 commonly) before the bulla very

faint, 1 (rarely 2) at or near the bulla, and 10–19 (usually about 16) beyond it better developed. Abdomen above fuscous or pistazinous, the segments narrowly darker immediately before their pale extreme apical edges, their sides paler and concolorous with the venter; in segments 2–7 from the lateral line near the base of the segment on each side of the dorsum a dark fuscous stripe (sometimes black towards its origin) ascends obliquely, growing gradually lighter and less defined, and blends with the dark colouring along the midst of the posterior border of the segment; these stripes are most strongly marked in the hinder segments. Venter in the anterior segments spotless, pale or cinereous, in 7–10 more or less lutescent or orange-tinted; forceps black or greenish black, paler inside distally; penis testaceous. Setæ sepia-grey, becoming whitish distally, sometimes black close to their origin; a few of the joinings near the base black.

♀ (*living*).—Markings similar to those of the subimago. Oculi subglaucous, with their orbits and the line across subpiceous. Ground-colour of thorax light fusco-olivaceous; the oblique abdominal stripes are sometimes abbreviated, the stigmata marked with a dark dot. Wings and neuration colourless. Fore tarsus concolorous with the tibia, its joints narrowly edged above at the tips with blackish like those of the hinder tarsi, whose ungues are sometimes slightly rubiginose. Venter pale ochraceous; setæ sometimes greyish white, sometimes greyish; ventral lobe slightly excised. In other respects similar to the ♂.

Dried specimens have the main nervures of the wings pale amber-colour, the great cross vein of the fore wing blackish or piceous, the costa beyond it greyish, and the bulla black; the cross veinlets remain pellucid as a rule. In some specimens the hinder tarsi are a shade darker than the tibiæ. The lateral stripes of the abdomen sometimes are reduced to spots, and sometimes are almost obliterated. Length of body 6·5–9; wing 7–10; setæ, ♂ im. 11–15, subim. 6·5, ♀ im. 9–10, subim. 6·5 mm.

Hab Common on the continent, in rivers and streams, from Holland and Germany southwards to Switzerland, the Pyrenees, and Portugal, *e. g.* at the following places:—Arnhem, Halle, Dresden; Basle, Berne, Versoix; Brive, near Le Puy (Haute Loire), Toulouse, Taraseon (Ariège), Orthéz; and Ponte de Marcellos (Beira Baixa).

Herr Rostock's identification of this species with Burmeister's ‡ *B. aurantiaca* appears compatible with the latitude of interpretation allowed to the descriptions of more than forty years' standing. Burmeister omits to mention the conspicuous dark spots on the femora; but Pictet did just the same thing with respect to those of the preceding species; and therefore no stress need be laid upon the omission.

Rhithrogena germanica, sp. nov. Plate XXIV. 43 *b* (penis dried).

Imago (*dried*), ♂.—Notum pitch-brown anteriorly, pitch-black posteriorly. Abdomen fusco-piceous or picco-fuscous, paler by the dorsal joinings. Setæ fuligineo-piceous. Fore femur piceous; tibia fuligineo-piceous. Hinder femora picco-lutescent, each with a dark median band, the trochanters rather lighter; tibiæ light yellowish amber; tarsi fusescent, with piceous ungues. Wings vitreous, tinged slightly with light olive-grey

in the marginal and submarginal areas; costa, subcosta, and radius piceous; the remaining neuration either pitch-black or black Length of body or wing 14; setæ, ♂ im. about 28, subim. about 16 mm.

Hab. The Rhine, near Lauffenburg (Berne Mus.).

PÆGNIODES, Etn. 1881.

Illustrations. Adult (details), Pls. XXIII. & XXIV. 41.

Adult.—First joint of the hind tarsus shorter than the second, which equals the third joint in length; the corresponding joints of the intermediate tarsus similarly proportioned; first joint of the ♀ fore tarsus much (about $\frac{1}{2}$) shorter than the second, and this rather longer than the third joint; ungues mutually dissimilar. Penis-lobes rather narrow and subcylindrical, with suddenly enlarged patulous tips, in the typical species. —Fore leg of ♂ defective in the specimens examined; but the first tarsal joint is shorter than the second. Fore tarsus of ♀ about $\frac{3}{4}$ the length of the tibia, and this about as long as the femur; the tarsal joints in the order of their shortening rank 2, 3, 5, 1, 4, and the first is nearly $\frac{1}{2}$ as long as the second. Hind tarsus of ♀ nearly $\frac{4}{7}$ the length of the tibia, and this about $\frac{7}{8}$ as long as the femur; its joints in the order of their shortening rank 3 subequal to 5, 2, 1, 4. Ungues each unlike the other in every tarsus. Hind wings of usual form; the axillar region narrow. Penis-lobes at the base subcylindrical, but distally enlarged suddenly to a moderate extent in the typical species; the seminal ducts apparently open into the capacious cavities of the hollow lobes; inferior stimuli well developed. Forceps basis saliently curved to a moderate extent in the middle behind. Ventral lobe of the ninth ♀ abdominal segment entire. Outer caudal setæ in both the sexes about thrice the length of the body.

Type. P. cupulatus (in *Heptagenia*), Etn.

Distribution. China and Tibet.

Etymology. παιγνιώδης, sportive.

PÆGNIODES CUPULATUS, Etn. Plate XXIII. 41 (part of fore wing, hind wing), XXIV. 41 (legs ♀ & ♂ genitalia).

Heptagenia cupulata, ! Etn., Trans. Ent. Soc. London (1871) 138, pl. vi. 14, 14*a* [detail]; Palmén, Paar. Ausf.-Gänge d. Geschl. Org. b. Insect. S. 74 [anatom.] (1881).

Pægniodes [type] *cupulatus*, ! Etn., Ent. Mo. Mag. xviii. 23 (1881).

Subimago (*dried*).—Wings light raw-umber grey, the hind wings very narrowly edged with black-grey along the terminal margin; longitudinal neuration raw-umber brown; cross veinlets mostly pitch-brown or pitch-black.

Imago (*dried*), ♂.—Thorax deep brown-ochreous above, the pronotum with a double black spot in the middle, the metapleura with a descending brown-purple stripe. Abdomen light brown-ochreous above, with a median longitudinal streak, the apical borders of the segments, and in each of the segments 2–8 on each side, with a broad

oblique lateral stripe from the hinder border to the spiracular line, and a fine abbreviated streak from the hinder angle of the dorsum along the same line, intense purple-madder-brown, or purple-black; venter unicolorous. Setæ light burnt-umber brown. Legs dull translucent rufo-lutescent, almost rufous, the fore leg with the apical projection of the tibia pitch-brown, and the tarsus light brown-ochreous. Wings vitreous; the fore wing from the base to the pterostigmatic space in the marginal and submarginal areas faintly tinted with light yellowish-green, and from thence to the apex coloured with raw-umber brown; the hind wing in the larger portion of the marginal area tinted with light yellowish-green, and along the terminal margin narrowly bordered with black-grey or brown-black; longitudinal neuration mostly pitch-brown, the costa of the fore wing in some lights seeming darker, and the nervures near the wing-roots, the subcosta and radius for some little distance farther, and the great cross vein, light raw-umber; cross veinlets pitch-black.

♀. Neuration of wings pitch-black, excepting the bases of the costa and subcosta, the great cross vein, and the proximal extremities of the longitudinal nervures posterior to the radius, which are very light raw-umber brown. Legs rufo-lutescent, with the terminal joint of every tarsus intense warm sepia-brown. Egg-valve acute; ventral lobe of the penultimate segment entire, and traversed by a median longitudinal fold. Length of body, ♂ (large example) 18, ♀ 16; wing, ♂ 11–15, ♀ 21; setæ, ♂ im. 48 (or more), ♀ 54 mm.

Hab. China, Hong Kong (Brit. Mus.).

Three Nymphs, *generis incerti*, of the *Ecdyurus* type.

Nymph No. I.—Pl. LVII. (whole figure and details).

Six anterior pairs of the abdominal tracheal branchiæ provided with broad, pointed laminæ recumbent upon the sides of the dorsum; seventh pair spreading, the laminæ linear-lanceolate and minute. Each of the anterior laminæ is oblique, somewhat obovate and cuspidate, but is asymmetrical, the lower margin being either truncate obliquely or sinuate, and the opposite side slightly dilated, between the base and the widest part of the lamina, while the cusp is nearer the upper than the lower edge; each contains a strongly defined fruticosely branched trachea, and partially overlies the branchial filaments, which are not fascicled in the usual manner, but explanate, and connected together by their membrane for some distance from the roots, thus constituting a single subrotund lamella, fringed deeply with long branching filaments, annexed to the base of the lamina. The hindermost laminæ each contain a pinnately branched trachea, and are pilose at the edges, but apparently lack fibrils. Median caudal seta subequal in length to the others and to the body; their joinings beset with minute spreading hairs. Pronotum transverse, very short, well defined behind; its lateral margins slightly dilated; its posterior margin rounded off obtusely towards the sides, and sinuate in the middle. Ventral segments 2–5, short, the hinder ones successively longer; the lobe of the ninth segment of ♀ elliptical at the tip, and sinuate on each side thereof; pleuræ

shortly and acuminately produced into teeth at the hinder angles of segments 7–9. Fangs of the mandibles slim, compressed and subeqal in length; the exterior tridenticulate at the summit, and serrulate along the superior edge; the interior fangs diversiform, terminated each by a tooth and two denticulations; in the right mandible the tooth is intermediate between the denticulations, is subulate, elongate, and slightly twisted, and the inferior denticulation is preceded by a few short hairs placed in a row along the edge of the fang; in the left mandible the tooth is somewhat conical and is above the denticulations. Lacinia of maxilla 1. beset at the edge of the crown with short appressed triangular pectinate teeth, and terminated by two simple pungent spinules; proximal joint of the palpus stout; terminal joint comparatively slender, its inner side nearly straight, the outer side gently curved, pungent at the point and somewhat pilose in proximity to its termination externally. Median lobe of the tongue inflated, subovate, grooved lengthwise in the middle nearly as far as the tip, and then transversely tumescent; paraglossæ broadly dilated, slightly recurved at the tips, and much larger than the median lobe. Femora, on the coloured side, banded with grey in two or three places; the bands confluent below. Length of body 7; setæ about 7 mm.

Hab. Niagara and Trenton Falls, N. Y. (G. H. Hubbard, 20 & 22, v. 1874); Dakota (Coues, 1872 & 1873), common; also N. Illinois (Prof. W. A. Forbes, vi. 1883). Figured and described from specimens communicated by Dr. Hagen (in Mus. Comp. Zool. Cambridge, Mass.).

It is possible that the Swedish insect figured by De Geer, Mém. pour servir à l'Hist. des Ins. ii. part ii. pl. xviii. 1–4, may be congeneric with Nymph No. I. The nymph was found by him in May in a ditch by the gardens of Leufsta, near Dannemora, in which grew many species of aquatic plants. Towards the end of May the imago appears, of which the oculi are sea-green. The nymphs climb up the plants to undergo the penultimate moult.

Nymph No. II.—Pl. LVIII. (whole figure and details).

Six anterior pairs of the abdominal tracheal branchiæ provided with broad, obtuse or retuse laminæ recumbent upon the sides of the dorsum; laminæ of the seventh pair linear-lanceolate and spreading. The anterior laminæ are quadrilateral, longer than broad, oblique at the base, pilose at their exposed edges, and pergamentose; all but the foremost are auricled at the base on the lower side, and all are slightly sinuate at the base on the upper side, the foremost being merely dilated instead of auricled correspondingly; distally the first three are truncate and slighly retuse, but the next three are obtusely rounded at the extremities; the hindermost laminæ, linear-lanceolate, acuminate and ciliated, lie outwards and obliquely backwards from the sides, and seemingly are destitute of branchial fibrils. Each of the anterior laminæ contains a strongly defined fruticosely branched trachea, and partially overlies the explanate branchial fibrils which are connected together by membrane as in Nymph No. I., but more extensively and so as to resemble an oval membranous lamella, deeply fringed with branched filaments, and produced into a laciniated auricle at the base on the

upper side (*i. e.* the side farthest from the auricle of the pergamentose lamina). Median caudal seta about $1\frac{3}{7}$ as long as the others, and twice as long as the body; their joinings beset with minute spreading hair. Pronotum transverse, imperfectly delimited, being confluent with the mesonotum at the lateral margins (although well defined elsewhere) and there slightly dilated anteriorly. Ventral segments short, the lobe of the 9th in the ♀ triangular; pleuræ in segments 6–9 produced posteriorly into short acuminate triangular teeth. Fangs of the mandibles slender, compressed, subequal in length; the exterior 2–3 denticulate at the tip, and serrulate at the upper border; the inferior fang bidendate in the right mandible, tridentate in the left, without remarkable differences in the teeth. Maxilla 1. and tongue very similar to those of Nymph No. I.; the former more sparsely beset with spinules and ciliæ, in the place of pectinate teeth, at the edge of the crown, and with stronger fangs at the point; its palpus furnished with a compressed acute spine below its pungent point. Femora marked on the coloured side with two broad dark bands, each containing a pale blotch upon the upper margin; the bands are confluent below. Length of body 7·2, setæ 13 mm.

Hab. The Falls of Niagara, N. Y., 3 examples by Mr. H. Hubbard, 22, v. 1874 (Mus. Comp. Zool. Cambridge, Mass.); also 3 or 13 probably from Ithaca, Fall Creek, N. Y., and 6 from Crystal Lake by Prof. S. A. Forbes. Figured and described from specimens communicated by Dr. Hagen.

Nymph, No. III.—Pl. LIX. (whole figure and details).

Abdominal tracheal branchiæ all reclinate at the sides of the body, with moderately long fascicled fibrils; laminæ oblique, the foremost and the hindermost two obtuse and almost semi-obovate, the others subovate, triangular, and broad; branchial tracheæ well developed, arborescently branched, excentric, with their longer branches ascending or directed towards the broader sides of the laminæ. Caudal setæ defective in the specimens examined; the median seta well developed. Pronotum transverse, very short, well defined behind; the lateral margins dilated and rounded off. Ventral segments subequal in length; the lobe of the ninth segment of the ♀ narrowly elliptical at the tip; pleuræ in segments 6–8 produced into minute acuminate teeth. Fangs of the mandibles slender, unequal, stronger in the left than in the right mandible; the exterior fang, bifid, and denticulate along its upper side in the latter, is in the former more compressed, acuminately lanceolate, and serrulate along both edges; the interior fang, slightly bifid, or slenderly bidentate in both of them, is in the right mandible obviously stunted, and in place of an endopodite has three short unilaterally plumose setulæ, while the other mandible has only a single smooth setula in that place. Lacinia of maxilla 1. beset at the edge of the crown with numerous flattened pectinate teeth, and with a few bristles at the point instead of spines; proximal joint of the palpus stout; terminal joint slenderly clavate, obliquely truncate, densely pubescent at the end and acute at the tip. Tongue very similar in form to those of the preceding two nymphs. Femora marked on the coloured side with three irregular zigzag grey fasciæ, narrowly confluent in the middle, preceded by a solitary oval spot near the base. Length of body 7 mm.

Hab. Dakota, 1872; 20 examples captured by Mr. Coues (Mus. Comp. Zool. Cambridge, Mass.) communicated by Dr. Hagen.

HEPTAGENIA, Walsh, 1863; restricted, Etn. 1881.

Illustrations. Adult (details), Pls. XXIII. & XXIV. 45; see also [anatom.] citations of Palmén (1884) under *H. flavipennis* and *sulphurea*; (whole figures) see citations, under the same species of Sulzer (1776), Panzer (1805), and Pictet (1843–5). *Nymph*, Pl. LX.

Adult.—First joint of the hind tarsus shorter than the second, which is either equal to or a little longer than the third joint; the corresponding joints of the intermediate tarsus of like proportions; first joint of the ♂ fore tarsus much shorter than the second, and this equal or subequal in length to the third joint; first joint of the ♀ fore tarsus much shorter than the second, which slightly exceeds the third in length; ungues each unlike the other. Penis-lobes somewhat explanate, oblong, and subtruncate at their divergent extremities.—Fore leg of ♂ about $1\frac{1}{2}$ the length of the body; tarsus about $1\frac{3}{5}$ as long as the tibia, which is very little longer than the femur; the tarsal joints in the order of their shortening rank 2 equal to 3, 4, 5, 1, and the first is about $\frac{1}{4}$ as long as the second joint. Fore leg of ♀ about equal in length to the body; tarsus about $\frac{2}{3}$ as long as the tibia, which is about $\frac{1}{1}\frac{2}{3}$ as long as the femur; the tarsal joints in the order of their shortening rank 2, 3, 5, 4, 1, and the first is $\frac{1}{3}$–$\frac{2}{5}$ as long as the second joint. Hind tarsus of ♂ about $\frac{2}{5}$ as long as the tibia, which is less than $\frac{5}{6}$ as long as the femur; its joints in the order of their shortening rank in ♂ 5, 2 equal to 3, 1, 4, in ♀ 5, 2, 3, 1, 4. Ungues each unlike the other in every tarsus. Hind wings of ordinary form; the axillar region narrow. In the dried ♀ abdomen the relative lengths of the dorsal segments 2–10 may be formulated thus:—5, 7, 8, 8, 10, 10, 8, 6, 7; ventral lobe of the ninth segment obtusely rounded or retuse. Forceps-basis of ♂ seldom truncate behind, usually slightly prominent between the insertions of the limbs, and retuse in the middle. Penis lobes rather broad, flattened beneath, subtruncate at the tips, and curved outwards to a moderate extent divergently; stimuli well developed, adjacent to the median line. Outer caudal setæ of ♂ $1\frac{1}{2}$–$2\frac{1}{2}$ (but usually twice) the length of the body; those of ♀ $1\frac{1}{4}$–$2\frac{1}{2}$ its length. Vertex of ♀ head transverse; the edge of the occiput, transverse in the midst, ascends at the posterior orbits of the oculi usually only in a slight degree; median ocellus prominent, contiguous with the anterior margin of the upper surface of the head. Pronotum of ♀ subcordately excised behind; the reflexed lateral lobes only slightly rounded posteriorly.

Subimago.—Wings tinted with yellowish, very rarely with greyish; neuration opaque, the cross veinlets acquiring a black tint and narrow dark grey borders, the membrane likewise becoming transversely striped in the disk, and the terminal margins bordered with greyish, shortly before the final moult.

Nymph.—Abdominal tracheal branchiæ spreading at the sides; branchial fibrils fascicled and about as long as the narrowly lanceolate laminæ, of which the fifth is the longest, the others shortening successively in a slight degree in both directions therefrom; branchial tracheæ indistinct in the laminæ after death, through the absence of pigment.

Median caudal seta subequal to the others, about $1\frac{2}{7}$ as long as the body, and beset at the joinings on both sides nearly throughout with minute spreading pubescence, while they are similarly beset on the inner side only. Pronotum well defined, sinuate in the middle posteriorly; its lateral borders scarcely at all dilated, nearly straight, but rounded off slightly in front. Fangs of the mandibles strongly developed, subequal, inflected and compressed; the exterior somewhat triangular, acute, serrulate along the upper edge; the interior fang bifid; endopodite absent, represented perhaps by a minute tuft of hair in the left mandible, and a single short hair in the right. Lacinia of maxilla 1. beset at the outer edge of the crown with flattened pectinate teeth, and terminated by two contiguous flattened spines at the point; first joint of the palpus stout; terminal joint slender, slightly clavate, oblique and velutinous at the end, and pungent at the point. Median lobe of the tongue obtuse and somewhat hexagonal; paraglossæ broadly expanded, almost oval, not recurved at the tips. Femora marked on the coloured side with a pair of large opposite confluent spots, forming an irregular distal band, and a pair of separate longitudinal opposite streaks near the base, sometimes connected with the band by dark colouring along the edges of the femur.

NORTH AMERICAN SPECIES.

HEPTAGENIA FLAVESCENS, Walsh.

‡ *Palingenia flavescens*, ! Walsh, Proc. Acad. Nat. Sc. Philad. (1862) 373; Hag., Proc. Ent. Soc. Philad. ii. 177 (1863).

Heptagenia [type] *flavescens*, ! Etn., Ent. Mo. Mag. v. 90 (1868); *id.*, Trans. Ent. Soc. London (1871) 112, pl. vi. 16 [detail ill drawn]; Hag., *op. cit.* (1873) 101; ! Etn., Ent. Mo. Mag. xviii. 24 (1881).

Subimago.—Wings slightly tinged with fuscous in ♂; in ♀ subflavescent, subopaque, with yellowish neuration, "except on the disk and tip," [where doubtless they are fuscous]. Setæ of ♂ dull greenish; of ♀ pale, a little fuscous at the tips.

Imago, ♂.—Yellowish. Eyes bright greenish yellow during life. Notum ferruginous, sometimes verging upon piceous. Dorsum of abdomen ferruginous, darker at the tips of segments 2–7, and with a pair of subobsolete pale vittæ at the base of each of them; venter pale greenish in segments 2–7 or –8. Setæ whitish; the joinings fuscous, and sometimes towards the roots alternately "white" [wide?] and narrow. Forceps pale, at the tips fuscous. Fore leg pale ferruginous, with a median and a terminal band on the femur, the tip of the tibia, and the tarsal joinings and tips fuscous. Hinder legs yellowish, with the tips of the femora fuscous, and the tarsal joinings and tips a little cloudy. Fore wing hyaline, with a pale ferruginous cloud in the pterostigmatic region; neuration fuscous, excepting the basal $\frac{2}{3}$ of the costa, subcosta, and radius, which are yellowish; the thickening at the bulla of the subcosta, about 0·5 mm. long, is more or less obfuscated. ♀ paler than ♂; vertex and notum rather luteous than ferruginous; dorsum of the abdomen pale fuscous or pale ferruginous, without any pale vittæ. Setæ in one specimen uniformly whitish. "The costal cross veins are hyaline on their basal $\frac{2}{3}$." Length of body 9–13; wing 11–15; setæ, ♂ im. 27–38, subim. 17, ♀ im. 27–28, subim. 13 mm.

Hab. Rock Island, Ill. [After Walsh.]

HEPTAGENIA INTERPUNCTATA, Say.

‡ *Bætis interpunctata*, Say, Journ. Acad. Nat. Sc. Philad. viii. 41 (1839); Pict., Hist. Nat. Névropt. ii., Ephém. 194 (1843–5); Walk., List of Neuropt. in Brit. Mus. part iii. 562 (1853); Le Conte, Complete Writings of T. Say, ii. 411 (1859); Hag., Smithson. Miscell. Coll. (1861) Synop. Neuropt. N. Am. 44.

‡ *Palingenia interpunctata*, Walsh, Proc. Acad. Nat. Sc. Philad. (1862) 374; Hag., Proc. Ent. Soc. Philad. ii. 177 (1863); Walsh, *op. cit.* ii. 190 (1863).

Heptagenia interpunctata, Etn., Trans. Ent. Soc. London (1871) 142.

Subimago.—Wings at first opaque and tinged with yellowish, afterwards becoming fuscous; neuration fuscous, excepting the basal $\frac{2}{3}$ of the costa, subcosta, and radius, which are yellowish, and the neuration of the axillar region of the fore wing, which (like the whole neuration of the hind wing, except at the tip) is light amber-coloured.

Imago, ♂.—Yellowish. Eyes during life pale greenish yellow, bisected horizontally by a black line; near their upper orbits is a black spot on each side, sometimes obscured by the vertex being obfuscated, and again below each of the antennæ is another black spot a little elongated transversely, which appears angular only when viewed obliquely. Prothorax marked with a black triangle at the base and a black line on each side; notum piceous. Abdomen in segments 2–7 or –8 "pale obscure greenish hyaline" [?=transparent and tinged faintly with greenish], with the terminal $\frac{1}{3}$ of each of them, and a median longitudinal line or stripe on the dorsum piceous, which stripe is usually broad, and when broad contains a pale spot on each side: the remaining dorsal segments almost entirely piceous: venter pale, obscure greenish, with the tips of the segments darker; forceps pale, sometimes cloudy at the tips. Setæ pale greenish, narrowly fuscous at the joinings, except in one immature specimen. Fore leg pale greenish yellow, with a median and a terminal band on the femur, the tip of the tibia, and the joinings and tip of the tarsus fuscous. Hinder legs somewhat paler, but similarly marked on the femur and at the extremity of the tibia, excepting in one instance where the median femoral bands were wanting. Wings hyaline; the fore wing clouded with yellowish brown along the costa, especially in the pterostigmatic space, and the hind wing tipped distinctly with brown; behind the bulla, in the midst of the interspace between the radius (3) and the sector (4) of the fore wing is a very coarse black longitudinal streak about 0·5 mm. long: neuration for the most part fuscous; but in their basal two thirds the costa, subcosta, and radius are yellowish; the cross veinlets in the marginal and submarginal areas of the fore wing are very coarse.

♀. Differs from the ♂ in having the black triangle at the base of the prothorax reduced to a dot; meso- and metanotum luteous. Abdomen in segments 2–9 egg-yellow above and beneath, with the piceous markings much narrower than those of the ♂, and with the ventral joinings pale instead of dark; segment 10 whitish. In the fore wing the costal border is uniformly clouded with yellowish, not darker in the pterostigmatic space, and the neuration in proximity to the inner margin, like that of all but the tip of the hind wing, is yellowish hyaline. Length of body 6–10; wing, ♂ 8–11·5, ♀ 8–14; setæ, ♂ im. 20–25, subim. 9–15, ♀ im. 14–24, subim. 7–14 mm.

Hab. Rock Island, Ill. [after Walsh]. Also Indiana (Say); Alleghany Mts., Va., Washington, D.C., Trenton Falls and Chicago (Osten Sacken, *teste* Hag.).

EUROPEAN AND ASIATIC SPECIES.

In Herr Rostock's analysis of the Saxon species of *Heptagenia*, some of the characteristics relied upon are in some degree variable with the individual specimen (*e. g.* the coloration or the partial deficiency in colour of the marginal area of the fore wing).

Heptagenia sulphurea, Müller. Plate XXIV. 45 (legs).

Ephemera sulphurea, Müll., Zool. Dan. Prodr. 142 (1776).—*E. helvola*, Subz., Abgek. Gesch. d. Ins. 171, pl. xxiv. 7 (1776).—*E. leucophthalma*, Ström, N. Saml. Kongl. Dansk. Vidensk. Selsk. Skrift. ii. 90 (1783); Wallengren, Christ. Vidensk. Forhandl. No. ii. 21 (1880).—*E.* ‡ *bioculata*, Römer, Gen. Ins. Lin. & Fabr. icon. illust. 23, pl. xxiv. 7 [after Subz.] (1789).—[*Ephemera*] or *E. ferruginea* [Zsch. Mus. Lesk. i. 150. no. 18 (1789)]; Gmel., Linn. Syst. Nat. ed. xiii. i. pars v. 2630 (1790); Ol., Encycl. Méth. vi. 422 (1791).—*E.* ‡ *bioculata*, var., Panzer, in Explic. Schæf. Ic. ccxxix. (1804); *id.*, Fn. Ins. Germ. init. Heft xciv. no. 17 (1805).—*E. citrina*, Hummel, Essais Entom. no. iv. 71 (1825).—*E.* ‡ *lutea*, ! Steph., Ill. Brit. Ent. vi. 55 (1835).

Bactis elegans, Curt., Lond. & Edinb. Philos. Mag. ser. 3 (1834) 120; ! Steph., Ill. Brit. Ent. vi. 64 (1835); Pict., Hist. Nat. Névropt. ii. Ephém. 193 (1843–5); Walk., List of Neuropt. in Brit. Mus. part iii. 560 (1853); Hag., Ent. Ann. (1863) 25.—*B. costalis*, Curt., Lond. & Edinb. Phil. Mag. ser. 3 (1834) 120; ! Steph., Ill. Brit. Ent. vi. 61 (1835); Pict. Hist. Nat. Névropt. ii. Ephém. 194 (1843–5); Walk., List of Neuropt. in Brit. Mus. part iii. 561 (1853).—*B. straminea*, Curt., Lond. & Edinb. Philos. Mag. ser. 3 (1834) 121.—? *B. marginalis*, Burm., Handb. d. Ent. Bd. ii. Abth. ii. 801 [excl. citations] (1839).—*B. cyanops*, Pict., Hist. Nat. Névropt. ii. Ephém. 171, pl. xx. 2 (1843–5); Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 556 (1853).—*B. sulphurea*, Pict., Hist. Nat. Névropt. ii. Ephém. 185, pl. xxiii. 8 (1843–5); Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 558 (1853); Brau., Neur. Austr. 74 bis (1857); Ausser., Ann. d. Soc. Natur. Modena, An. iv. 134 (1869); Joly, Rev. d. Sc. Nat. Montpellier, v. 323, pls. viii., ix. figs. 36–38 bis & 51, 52 [anatomical details] (1876).—*B.* ‡ *lutea*, Hag., Ent. Ann. (1863) 23.

Heptagenia elegans, ! Etn., Trans. Ent. Soc. London (1871) 145, pl. iii. 5 [wing] & vi. 18–18 b [details]; Hag., *op. cit.* (1873) 404; Meyer-Dür, Bull. Soc. Ent. Suisse, iv. 312 (1874); Rostock, Jahresb. d. Ver. f. Naturk. Zwickau, 1877, p. 90 (1878); Palmén, Paar. Ausf.-Gänge d. geschl. Org. b. Insect. S. 44, 64, 65, 74, 75, 77, 78, 83, 92, taf. ii. 28, 29, iii. 39–41, & iv. 58 [anatom.] (1884).

Subimago (living).—Eyes pale blue-verditer, or else pale yellow-green with a movable round spot surrounded by about half a dozen little circular specks of less intense grey; orbits of ocelli olivaceous; a small triangular black speck on each side of the face at the lower part of the inner orbit, and sometimes a rhomboid black spot close to the eyes on the vertex; a linear dash on the pleura just behind the fore coxa, and from 1 to 3 dots, also black, near and above the intermediate coxa. On each side of the mesonotum is a pitch-brown streak tapering forwards from the hinder part of the segment and angulated close to the wing-roots. Wings at first unicolorous sulphur-, or lemon-yellow; the membrane afterwards becomes dull greenish yellow, or even yellow-green (like fumes of chlorine); a tapering grey streak is developed transversely from near the inner-terminal angle of the fore wing, and another nearer the tip of the wing from the vicinage of the pterostigmatic space, while simultaneously a grey band of moderate breadth appears along the terminal margin and the cross veinlets together with a dot at the bulla turn

black. Fore femur and base of tibia light yellowish green; the remainder of the tibia lighter in tint; hinder femora and the bases of the tibiæ whitish, with a yellowish green tint; the remainder of the tibiæ smoky white. Tarsi smoky white, or greyish, with black joinings and ungues. Setæ smoky white with rufescent joinings. *When dried* the wings are transparent dull light yellowish, and it depends upon what was the period at which the specimen was killed whether the cross veinlets are also yellowish or else brownish or black.

Imago (*dried*).—Femora not dark-banded. Dorsum of the abdomen devoid of a longitudinal median dark stripe, but with the terminal margins of the segments narrowly dark-bordered nearly from side to side. Metathorax as pale at the sides as elsewhere.—♂ (*living*). Eyes at first cæsious, with a transverse dark line and movable markings like those of the subimago: sometimes they are tinged with pale yellowish green above, and more deeply so below. At a later period, and when viewed under artificial light, their colour changes to black or greenish black; but later still it is apt to become cæsious again. Head and sides of the thorax marked as in subimago with either black, piceous, or fuscous. Pronotum light greenish bistre, or olive-brown; the remainder of the notum either light pitch-brown or somewhat brown-ochreous: tegulæ, pleuræ, and sternum much paler, and variously coloured with pale greenish yellow, pale greenish brown, &c. Dorsum of abdomen in segments 1–7 or –8 (excepting at the sides) translucent light greenish brown, or olivaceous grey, narrowly darker (often pitch-black) at the terminal margins of the segments; segments 8 or 9–10 opaque, and more or less brown-ochreous varied with yellow ochre. Venter in segments 1–7 or –8, and the sides of the corresponding dorsal segments, very pale transparent olivaceous green; the remaining ventral segments opaque and somewhat yellow-ochreous. Setæ smoke-grey, or greyish white, with black, pitch-brown, or rufescent joinings. Fore legs subolivaceous, sometimes tinged with yellowish brown: tarsus smoky grey; the tip of the femur, both extremities of the tibia, and the tarsal joinings, blackened. Hinder legs yellowish-green or whitish amber-colour, with the tarsus and tip of the tibia smoke-grey, and often with the tarsal joinings blackened. Wings vitreous, with pitch-black neuration, excepting that, towards the roots, the principal nervures are often tinged with greenish- or amber-yellow: in the fore wing the whole of the submarginal area and at least the pterostigmatic portion of the marginal area are of a greenish- or yellowish-amber tint, the pterostigmatic parts being subopaque and often tinged with grey; but frequently the remaining portion of the marginal area is likewise amber-tinted. *In dried specimens* the greater portion of the wing-neuration becomes pitch-brown; the axillar fold of the fore wing is bordered externally with a slight brownish cloud; the legs to a large extent become strongly amber-coloured, and the notum raw-umber brown; while the thoracic pleuræ often lose the dark markings and become almost uniformly pale brownish yellow.

♀ (*living*).—Eyes either light yellowish green, glaucous, cæsious, or black; on each side of the face and vertex at the orbit of the eye is respectively a triangular black spot and a triangular fuscous spot. Notum laterally of the very lightest shade of brown-ochre, but along the middle fuscous, with the peaks of the meso- and metanota yellow-ochreous; in front of the upper part of the base of the intermediate coxa is usually a fuscescent or

black spot or streak. Dorsum of abdomen in segments 2–7 either very light olive-green or light gamboge-yellow, but in segments 8–10 light yellow or yellow-ochre; the terminal borders of the segments narrowly fuscous; venter spotless. Setæ white or greyish white, with dark or rufescent joinings. Legs gamboge- or amber-yellow; the tarsi greyish white, with black joinings. Wings vitreous; the fore wing usually tinged only in the marginal and submarginal areas with lemon-yellow, but sometimes a fainter tint of the same colour suffuses the remainder of the membrane universally; neuration mostly black, but the stronger portions of the longitudinal nervures, the great cross vein, and the axillar fold are gamboge- or amber-yellow. *In dried specimens* the notum becomes light brownish ochre, instead of fuscous, along the middle, and in many positions the longitudinal neuration of the wings becomes amber-yellow, while the cross veinlets remain pitch-black or black; the colouring of the wing-membrane in the marginal and submarginal areas of the fore wing of ordinary specimens becomes brownish amber, and is most apparent only in the submarginal area and in the pterostigmatic portion of the marginal area, though not entirely deficient in the remainder of the former area.

Variation, ♂ im. (*dried*).—The abdomen is almost uniformly light pitch-brown (excepting, as usual, the terminal edges of the dorsal segments), and the tract of the dorsal vessel is subopaque, but not so dark as to be reckoned as a dark dorsal stripe. *Hab.* Ponte de Morcellos (Beira Baixa), Portugal.

Length of body, ♂ 7–10, ♀ 9–11; wing, ♂ 8·5–12, ♀ 11–13; setæ, ♂ im. 16–23, ♀ im. 14–19, subim. ♂ & ♀ 12–15 mm.

Hab. Generally distributed in Europe in streams and the swift parts of rivers from at least Hammerfest to the south of France and northern Portugal, and from Great Britain to southern Russia. May to September. In Brauer's description of the ♂ fore tarsus "dritte" is written for "vierte."

Heptagenia cærulans, Rostock.

Heptagenia cærulans, ! Rostock, Jahresb. d. Ver. f. Naturk. Zwickau, 1877, p. 89 (1878).

Imago.—"Thorax yellow-brown, darker behind. Abdomen brown above, darker at the tips of the segments, ochreous at the sides and beneath, and tinged with orange in the last three segments. Forceps brownish. Setæ smutty-white, annulated with darker towards the tips. Fore leg of ♂ testaceous-brown, with darker joinings. Fore wings with bluish iridescence, the marginal area either colourless or, at the most, tinged with yellowish at the apex. Expanse of wing 21; length of setæ, ♂ im. 25 mm." [After Rostock.]

Hab. Weisseritz, near Dretschen, Saxony (Rostock). I have had no recent opportunity of comparing this species with *H. gallica*. As nothing is said by Herr Rostock of any spot at the side of the metanotum, or of any dorsal abdominal stripe in *H. cærulans*, I have supposed them to be distinct species.

Heptagenia flava, Rostock.

Heptagenia flava, ! Rostock, Jahresb. d. Ver. f. Naturk. Zwickau, 1877, p. 90 (1878).

Subimago (*dried*).—Wings dull light yellowish, less transparent than in *H. sulphurea*; the hind wings broadly bordered with a light greyish cloud along the terminal margin; the fore wing faintly tinged at the pterostigma with very light red-purple, or purple-madder. Neuration at first lutescent, the cross veinlets turning black as in *H. sulphurea*. Setæ lutescent with dark joinings.

Imago (*dried*).—Femora not dark-banded. Dorsal segments 1–7 ♀ or 1–10 ♂ of the abdomen traversed lengthwise by a dark median stripe, and dark-edged halfway across the terminal border on each side of the stripe. A dark stripe on each side descends obliquely from the first dorsal segment, running close behind the hind wing-roots and the spiracle, and just in front of the insertion of the hind leg.— ♂. Thorax brown-ochreous or piceo-luteous above, "with a dark violet-brown spot on each side of the prothorax." Abdomen bright yellow, with a broad stripe along the middle of the back strongly tinged with purple-madder, darkest above the dorsal vessel and at the joinings for a short distance on each side of that; in some examples the ordinary curved pale translucent line is visible on each side of the dorsal vessel in segments 2–5, and the other markings comprise a median linear black-purple stripe extending from segment 1 to segment 7 or 8, and a purple-madder band extending halfway across the back along the distal margin of each of these segments, and then produced forwards almost at right angles with the margin in a linear stripe to the basal joining of the segment, so as to enclose a light-coloured blotch on each side of the median stripe at the base of the segment. Setæ white or pinkish white, with reddish joinings. Fore femur brown, tinged with madder-purple, chiefly so where in other species the two dark bands are placed; fore tibia and tarsus testaceous, or in transmitted light pale amber-yellow, the extremity of the tibia, the tarsal joinings, and the ungues burnt-umber brown; hinder legs very light testaceous, or else amber-yellow, with an ill-defined purple-brown mark at the end of the femur, best seen in the intermediate leg and at the lower edge of the limb; their tarsal joinings and ungues purple-brown. Wings vitreous; the fore wing tinged with light amber-yellow in the base and pterostigmatic portion of the marginal area, and in the whole of the submarginal area; in the pterostigmatic part of both areas, about halfway between the bulla and the apex, is a faint red-purple cloud; neuration for the most part pitch-black, the costa, subcosta, and the radius to beyond the middle light pitch-brown or yellowish brown, the bulla pitch-black; the axillary nervures and the proximal extremities of the others very light yellowish brown.

♀. Very similar; the inner orbit of each eye with a black line below running inwards towards the carina, and a black triangular streak above tapering backwards obliquely. Pronotum with a curved tapering purple-black streak on each side directed obliquely downwards from the upper posterior angles. The indistinct markings of the legs are similar to those of the male, but the fore femur is less tinged sometimes with madder-purple, and the burnt-umber brown at the tip of the fore tibia is restricted to the joining. Length of body 9–12; wing, ♂ 10–12, ♀ 11–15; setæ, ♂ im. 24, subim. 13, ♀ im. 15–25, subim. (large example) 19 mm.

Hab. Middle Europe; Arnhem in Holland, near the railway bridge, 27th July; near Dretschen, Saxony (Rostock). In M'Lach. Mus. are two examples from Herr Rostock,

and eight (probably from Posen), captured during the second fortnight in June, from Prof. Zeller. The red-purple tint in the pterostigmatic region of the fore wing, the black-purple dorsal stripe, and the faint traces of the almost obliterated purple-brown femoral bands serve to mark off this species from its very similar neighbours.

HEPTAGENIA GALLICA, sp. nov. Plate XXIII. 45 (fore wing), XXIV. 45 *a* (♀ tarsi 1 & 2, penis dried). *Nymph*, Plate LX.

Heptagenia [nymph], ! Etn., Ent. Mo. Mag. xviii. 25 (1881).—*H. gallica*, ! *id.*, in the writing of the plates cited above (1883).

Imago (*dried*).—Femora, each more or less faintly marked with a dark median band, which bands in some [possibly newly moulted] specimens are incomplete, the colouring matter extending only part way across from the under edge of the femur. On each side of the metanotum above the insertion of the hind coxa is a dark spot, which is relatively large and rounded in ♂, but quadrangular and smaller in ♀. Tract of the dorsal vessel narrowly bordered with brownish; the terminal edges of the intermediate dorsal segments are entirely dark.—♂ (*living*). Eyes at first black, changing to cæsious with a black transverse line. Thorax raw-sienna above, with the peak of the mesonotum and a large round spot just behind and below the hind wing-roots black. Dorsum of abdomen in the middle of the intermediate segments, and right across their terminal borders, fuscous; segment 10 raw-sienna; the sides of the dorsum in segments 2–7 translucent whitish, with the main trunk of the tracheæ in a large measure black. Setæ whitish, distally with every joining, but near the base with only the alternate joinings piceous. Hinder legs whitish amber or cretaceous, with greyish tarsi and black tarsal joinings: the spine of the trochanter and the median spot at the lower border of the femur blackish, the tip of the femur fuscescent. The fore femur, tinged with raw-sienna, is similarly marked with blackish, and the tip of the fore tibia and the terminal joint of the tarsus are also black; but the other joints of the fore tarsus are concolorous with the tibia with black joinings, excepting the first joint, which is greyish. In front of the basal joining of the hind coxa is a dark dash; the mesosternal ganglion shows as a cordate fuscous blotch. Wings vitreous, with piceous neuration; the great cross vein, towards the costa, and the proximal extremities of the longitudinal nervures of the fore wing are deficient in colour; in some positions the costa, subcosta, and radius of this wing become bistre-brown, and *in transmitted light* the neuration, as a whole, appears brownish amber-colour. The pterostigmatic region is sometimes very faintly tinged with brownish.—*When dried* the notum is brown ochreous, varied behind with pitch-brown; the fore tibia and tarsus become very light brown-ochreous with blackish markings. Hinder legs very pale yellowish amber, with greyish markings; the bands at the tips of the femora become obsolete.

♀ (*dried*).—Before oviposition the insect closely resembles *H. flava* in its colouring; but afterwards it is as follows:—Thorax above pale yellowish ochre, approaching Naples yellow, varied behind, and also below the tegulæ in front, with a whiter ochre. Abdomen in segments 2–7 translucent dull whitish ochre, with the terminal margins of the segments narrowly dark grey across the back, and with a brownish streak from in front, tapering

posteriorly, on each side of the tract of the dorsal vessel, and another very faint triangular cloud of a similar tint from the hind margin of the segment, on the outer side of the streak, tapering forwards, tending to enclose between them a small curved pale space; the main tracheal trunks are greyish in segments 6–8, but hardly perceptibly so in the anterior segments; segments 8–10 opaque, light yellow-ochre, with the vulva brown-ochreous. Setæ white, with dark joinings. Wings vitreous throughout, with the greater part of the neuration piceous, but with the stronger parts of the longitudinal nervures and the great cross vein of the fore wing *in opaque view* light dull yellowish or yellowish grey; in transmitted light the longitudinal neuration acquires amber-tints, while in most positions the cross veinlets remain black. The markings of the hinder femora are more distinct than in the other sex; and just before the extremity of the femur the lower edge of the limb is for a little distance black. Length of body, ♂ 10; wing, ♂ 11, ♀ 12; setæ, ♂ im. 24, ♀ im. 22 mm.

Hab. Netherlands, near Arnhem, end of July. France, at Toulouse, July–September; common near the Pont d'Empalôt, and by St. Michel opposite the island. The newly-moulted nymph is entirely light yellowish; but on immersion in a solution of alcohol the greyish-black markings become developed after death.

HEPTAGENIA FLAVIPENNIS, Dufour.

‡*Ephemera flavipennis*, Dufour, Mém. par divers savans, Instit. de France, viii. 580 note (1841).

‡*Baëtis longicauda*, Steph. Ill. Brit. Ent. vi. 63 (1835) [*nomen ineptum*]; Pict., Hist. Nat. Névropt. ii. Ephém. 193 (1843–5); Walk., List of Neuropt. Ins. in Brit. Mus. part. iii. 560 (1853); Hag., Ent. Ann. (1863) 24.—‡*B. cerea*, Pict., Hist. &c. 183, pl. xxiii. 2 (1843–5); Walk., List. &c. iii. 558 (1853).

Heptagenia flavipennis, ! Etn., Trans. Ent. Soc. London (1871) 141, pl. vi. 17–17 *c* [details]; Meyer-Dür, Bull. Soc. Ent. Suisse, iv. 312 (1874); Rostock, Jahresb. d. Ver. f. Naturk. Zwickau, 1877, p. 90 (1878); Palmén, Paar. Ausf.-Gänge d. geschl. Org. b. Insect. SS. 68, 74, 77, 78, taf. iv. 55 [anatom.] (1884).—*var.*? *H. volitans*, ! Etn., Trans. Ent. Soc. London (1870) 7; ! *id., op. cit.* (1871) 147, pl. vi. 20 [detail]; Rostock, Jahresb. d. Ver. f. Naturk. Zwickau 1877, p. 89 (1878); Palmén, Paar. Ausf.-Gänge d. geschl. Org. b. Insect. S. 52 [anatom.] (1884).

Subimago (*living*).—Eyes and wings very similar in colour and in their developed markings to those of *H. sulphurea*; the bullæ of the costa and subcosta, and the cross veinlets of the pterostigmatic region black. Femora of a light dull warm brown-ochre, banded in the middle and at the tip with light reddish; tarsi and tips of tibiæ greyish black. Setæ concolorous with the femora, scarcely opaque at the joinings. *When dried* the wing-membrane is brighter than in *H. sulphurea*, approaching in tint a very light shade of Mars-yellow or Italian ochre.

Imago (*dried*).—Femora (or at least the fore femur) more or less faintly dark-banded in the middle; but the bands often disappear from the hinder femora of dried specimens. On each side of the metanotum, behind the upper part of the insertion of the hind coxa, is a rounded black spot, which is small in both sexes. The tract of the dorsal vessel is not bordered; but the extreme terminal edges of the intermediate dorsal segments are dark almost from side to side.— ♂ (*living*), eyes bright or very light olive-green. Notum raw-sienna or furfuraceous. Dorsum of abdomen in segments 2–7 either greenish grey or light yellowish green, or light sulphureous, with the terminal margins of the segments

greyish black nearly from side to side; segments 8–10 raw-sienna. Setæ light brownish ochre with dark joinings. Legs as in subimago, but with the fore tarsus sepia-brown, dark at the tips of the joints. Wings vitreous, tinged with greenish yellow, especially towards the fore costa; longitudinal neuration blackish green; cross veinlets, and the bullæ of the subcosta and radius, black. *When dried* the notum becomes light brownish ochre; a small dark spot is visible on each side just above the hinder part of the insertion of the hind coxa. Segments 2–7 of the abdomen are translucent whitish, with a slight yellowish tint posteriorly and in the middle of the back, and are edged with light bistre-brown nearly across their terminal margins; their tracheæ are white. Segments 8–10 are bright brown-ochre. The fore wings are tinged with yellowish amber distinctly throughout the submarginal area, and also in the uttermost extremities of the two following areas; in the marginal area the tint is much fainter. *In opaque view* the finer longitudinal neuration and the cross veinlets appear black or piceous, while the great cross vein and the thicker nervures of the fore wing appear yellowish brown; *in transmitted light* the longitudinal neuration becomes yellowish amber, and the cross veinlets remain black. The bulla of the subcosta is thickened for some distance, and black.

Variation 1. ♂ (*dried*). The wing-membrane is faintly tinged with yellowish throughout the disk, and the stronger tint in the marginal area is as distinct as that of the submarginal area. The ground-colour of segments 2–7 and 10 of the abdomen is subopaque light yellowish approaching Roman ochre; that of segments 8 and 9 light reddish. *Hab.* Orthéz.

?*Variation* 2 [*volitans*]. Eyes of ♂ blackish brown. Notum atro-fuscous. Dorsum of abdomen light bistre-brown, with the tips of the segments darker. Setæ pale greenish grey, with darker joinings. *Hab.* Near Reading, Berks.

♀ (*dried*). Very similar to *H. gallica*; but the dark edging does not extend the whole way across the back along the terminal margins of segments 2–7, and the course of the dorsal vessel is not marked out; the main tracheæ also are whitish or pale. Setæ whitish, with reddish joinings. Wings vitreous, tinged throughout the submarginal area of the fore wing distinctly, and more faintly so in the marginal area with yellowish amber; neuration coloured as in the other sex; the bulla of the subcosta is thickened, and brownish or piceous. The median markings of the hinder femora are hardly perceptible; but close to the knee, very near the under edge of the femur, is a very small black spot or dot. On the head is a black dot on each side of the vertex close to the eyes, and another on each side below the eyes. Length of body 12–14; wing, ♂ 14–15, ♀ 17; setæ, ♂ im. 20–33, subim. 24, ♀ im. 21 mm.

Hab. England, near Reading, on the Kennet and Holybrook. Switzerland, at Basle (M'Lach.) and by the Lake of Geneva (Pict.). France, at Orthéz (Basses Pyrénées). June and July. The subimago emerges chiefly after sunset.

I refer here as a variation the insect described in 1870 as a distinct species,—*H. volitans*,—with some hesitation. The difference in the colour of the eyes is immaterial; the coloration of the legs is favourable to their identity. The colouring of the body, however, is a more serious obstacle to their union; but it may not be insurmountable.

COMPSONEURIA, Etn. 1881.

Illustrations. *Adult* (details), Pls. XXIII. & XXIV. 42.

Adult.—Joints 1–4 of the hind tarsus diminish successively in length; first joint of the ♀ fore tarsus rather shorter than the second, but longer than the third joint; ungues each unlike the other. Penis lobes subsimilar to those of *Heptagenia*. Cross veinlets conspicuously few in number in the fore wing.—[Proportions in length of the legs and body not recorded.] Fore tarsus of ♀ almost as long as the tibia, which is $\frac{4}{5}$ the length of the femur; the joints in the order of their shortening rank 2, 1, 3, 5, 4, and the first is about $\frac{4}{5}$ as long as the second. Hind tarsus of ♀ little more than $\frac{1}{3}$ as long as the tibia, which is about $\frac{5}{7}$ as long as the femur; its joints in the order of their shortening rank 5 equal to 1, 2, 3, 4, and the first is about $1\frac{1}{7}$ as long as the second joint. Ungues each unlike the other in every tarsus. Hind wings of the ordinary form; the axillar region narrow. In the disk of the fore wing, posterior to the radius, are four somewhat dislocated transverse series of cross veinlets: of these the innermost, commencing near the junction of the sector (4) and cubitus (5), becomes irregularly dislocated inwards at the anal (8) nervure; the second (the nearest to the bulla), dislocated outwards in the sectorial region, becomes posteriorly, between the cubitus (5) and the hinder branch of the pobrachial (7), more nearly aligned with its commencement, running as a whole subparallel with the first series; the third, receding from a point nearly opposite the commencement of the pterostigmatic region, is interrupted between the fourth sectorial intercalary nervure and the cubitus, and its elements are diverted towards the fourth series between the cubitus and the anterior branch of the pobrachial; the fourth series, intermediate between the third and the extremity of the wing, meets the terminal margin between the cubitus and the præbrachial (6) nervures. Penis-lobes and other genitalia very similar to those of *Heptagenia*. Caudal setæ defective in the specimens examined.

Type. *C. spectabilis*, Etn.

Distribution. Malay Region.

Etymology. κομψός and νευρίον, from the elegance of the cross veinlets in the fore wings of the typical species. Possibly (as in *Callibætis*) they may vary in number and arrangement with the species.

COMPSONEURIA SPECTABILIS, Etn. Pls. XXIII. 42 (wings ♀), XXIV. 42 (♀ fore and hind legs, ♂ genitalia).

Compsoneuria spectabilis, ! Etn., Ent. Mo. Mag. xviii. 23 (1881).

Imago (dried), ♂.—Yellowish ochre approaching light straw-colour. Notum varied with pitch-brown. Segments 2–8 of the abdomen bordered narrowly in the midst of their posterior dorsal margin with black, and marked on each side with a black line ecurrent obliquely from that bordering towards the spiracle; segments 3–7 have also each a lanceolate black streak produced from the same bordering along the line of the dorsal vessel; segments 9 and 10 pale. Venter and forceps light yellow-ochreous. Hind

leg pale straw- or amber-yellow; the trochanter, a band in the middle and another at the tip of the femur, the base of the tibia, and the extreme edges of the tarsal joinings pitch-black; the other legs wanting. Wings vitreous; longitudinal neuration pellucid, excepting that the costa, subcosta, and radius are piceous towards the tip of the fore wing; cross veinlets piceous, and narrowly bordered with piceous.

♀. Very similar; but the general colouring of the body is brown-ochre instead of yellow-ochre. In the hind wing there are rather more cross veinlets than in the other sex. Length of body 6; wing, ♂ 7, ♀ 8 mm.

Hab. Lahat (in Leyden Mus.); received from Mr. C. Ritsema.

ECDYURUS, Etn. 1868; revived 1881.

Illustrations. Adult (details), Pls. XXIII. & XXIV. 46, see also [anatom.] citations of Palmén (1884) under *E. angustipennis* and *venosus*; (whole figures) see citations of Pictet (1843–5) under *E. helveticus, purpurascens, angustipennis, obscurus, lateralis,* & *montanus,* and of Curtis (1834) under *venosus*. *Nymph*, Pls. LXI. [junior] & LXII. (senior); see also Pictet, *op. cit.* (1843–5) pl. 16.

Adult.—In the hind tarsus joints 1–4 usually diminish successively in length, but the first is sometimes equal or subequal in length to the second joint; in the intermediate tarsus the first joint is more commonly as long as the second joint; first joint of the ♂ fore tarsus usually about $\frac{1}{2}$ as long as the second (in *E. helveticus* scarcely $\frac{1}{3}$ as long as the second joint), which is nearly of the same length as the third joint; first joint of the ♀ fore tarsus shorter than the second, which exceeds the third joint in length. Penis-lobes stout, usually broadly trilateral, but sometimes obovate; stimuli well developed, adjacent to the median line. Fore leg of ♂ 1–$1\frac{1}{2}$ as long as the body; tarsus about twice as long as the tibia, which is almost as long as the femur; the tarsal joints in the order of their shortening usually rank 2, 3, 4, 1, 5 [in *E. helveticus* 2, 3, 4, 5, 1] and the first is usually about $\frac{1}{2}$ [in *E. helveticus* about $\frac{1}{3}$ or $\frac{1}{4}$] as long as the second joint. Fore leg of ♀ subequal in length to the body or about $\frac{5}{7}$ as long as it; tarsus $\frac{5}{4}$–$\frac{11}{12}$ as long as the tibia, which is about $\frac{5}{6}$ as long as the femur; the tarsal joints in the order of their shortening rank usually 2, 5, 3, 1, 4 [in *E. helveticus* 2, 5, 3, 1 equal to 4] and the first varies in proportion to the second joint from about $\frac{6}{7}$–$\frac{6}{11}$ as long. Hind tarsus of ♂ about $\frac{4}{7}$ as long as the tibia, which is about $\frac{7}{9}$ as long as the femur; the joints in the order of their shortening usually rank 5, 1 equal to 2, 3, 4, but in the ♀ tarsus and in that of *E. helveticus* ♂ they rank 5, 1, 2, 3, 4. Ungues each unlike the other in every tarsus. Hind wings of the usual form; the axillar region narrow. In the dried ♀ abdomen the relative lengths of the dorsal segments 2–10 may be formulated thus:—5, 8, 9, 9, 9, 9, 7, 6, 6; ventral lobe of the ninth segment entire. Forceps-basis of ♂ usually slightly or moderately curved saliently behind between the insertions of the limbs, and sometimes with a small blunt projection or tooth on each side of the curve adjacent to their insertions. Penis-lobes stout, usually expanded broadly outwards at the tips, but sometimes obovate; stimuli well developed, adjacent to the median line. Caudal setæ of ♂ $2\frac{1}{2}$–3 times the length of the body, those of ♀

about $1\frac{1}{2}$ its length. Vertex of ♀ head transverse; posterior orbits of the oculi higher than the interjacent portion of the edge of the occiput; median ocellus prominent, contiguous with the anterior margin of the upper surface of the head. Pronotum of ♀ either retuse only or subcordately excised behind; the reflexed lobes somewhat rounded behind.

Nymph (*senior*).—Abdominal tracheal branchiæ, when not spread, obliquely reclinate at the sides, with well-developed suberect or ascending fasciculed fibrils; the laminæ successively increase in size from the first to the fifth pair, and then diminish gradually to the seventh; the fibrils attain their maximum development at the third pair, and decreasing successively from that point in opposite directions, both in density and length, are lacking in the seventh pair; the foremost laminæ, narrowly ovate-oblong in form, are (like the next two) small in proportion to the fibrils; those of the second pair are ovate, of the fifth pair ovate-oblong, of the seventh obliquely obovate, and the others exhibit intermediate gradations of form: branchial tracheæ well defined, commonly alternate-pinnately branched, but occasionally (as in Pl. LXII. 20) arborescent. Median caudal seta subequal to the others, minutely plumose, while they are unilaterally so, and about as long as the body. Pronotum completely defined; the lateral borders broadly dilated, rounded off in front, and produced behind into acute angles flanking the anterior portion of the mesonotum. Ventral segments subequal in length; the lobe of 9th segment of ♀ subtriangular; pleuræ narrowly dilated, saliently curved at the outer edge anteriorly, and shortly acuminate behind, so as to form minute teeth. Fangs of the mandibles narrowly subfalcate; the exterior, and stronger, serrulate at the edges; the interior, more slender and shorter, is in the left mandible or tridendate at the point; in the place of the endopodite, in both mandibles, is a short tuft of plumose hair. Lacinia of maxilla 1. beset with flattened pectinate teeth along the edge of the crown, and terminated by a pair of contiguous flattened subulate spines at the point: first joint of the palpus moderately stout; terminal joint slender, clavate, obliquely truncate and densely velutinous at the end, pungent at the tip, and pubescent externally. Median lobe of the tongue truncate-subcordate, with the auricles excised; paraglossæ broadly unciform, with the points recurved. Femora marked on the coloured side with two irregular zigzag grey bands composed of confluent spots, and apt to be respectively connected with a spot near the base, and another, or two, near the tip.

The nymphs figured respectively in Pl. LXI. and Pl. LXII. 24, probably are merely junior grades of species of *Ecdyurus*; and the latter is the younger, judging from the completeness of the delimitation of the pronotum at the hinder lateral angles. The somewhat older N. American nymph (Pl. LXI.) differs from that of *E. venosus* of senior grade in the following particulars. The lateral borders of the pronotum are not produced posteriorly, but are intimately blended with the mesonotum; and hence the pronotum wants definition at the hinder lateral angles. The mandibles lack the tufts of hair adjacent to the bases of the interior fangs; and the left mandible has a single slender bristle in their place, like that of those figured in Pls. LVIII., LIX. The median lobe of the tongue resembles somewhat that of the nymph last referred to; but the paraglossæ differ both from those of that nymph and from those of the senior

Ecdyurus, being broader at the base, less recurved and more pointed at the tips: and the tongue as a whole bears some resemblance in outline to an Eagle Ray (*Myliobatis aquila*). Resident in rivers and streams.

Type. *E. venosus* (in *Ephemera*), Fab.

Distribution. Europe eastwards to Siberia, the Caucasus and the river Euphrates; the Himalaya; North America from Texas northwards.

Etymology. ἐκδύω and οὐρά, in allusion to the abortion of the median caudal seta.

NORTH AMERICAN SPECIES.

ECDYURUS CANADENSIS, Walker.

‡*Baëtis canadensis*, ! Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 569 (1853); Hag., Smithson. Miscell. Coll. (1861), Synop. Neuropt. N. Am. 47.

Heptagenia canadensis, ! Etn., Trans. Ent. Soc. London (1871), 138, pl. vi. 12, 12 *a*.

Imago (*dried*), ♂.—Head and thorax above rufo-piceous or rufo-lutescent, with a large black spot on each side of the face below the antennæ adjacent to the orbits of the eyes: the pleuræ streaked with piceous above the interspaces in advance of the hinder coxæ. Abdomen in segments 2–9, translucent, subochraceous, or very light bistre-grey, the 10th segment rufescent, the apical borders of the previous segments across the middle of the back, and the lateral spots or oblique stripes prolonged forwards from them pitch-black; venter very light whitish ochreous. Setæ pale, with fuscous joinings. Fore femur (as an opaque object) rufo-lutescent or (with transmitted light) translucent bistre-brown, with a broad black band at the base, another in the middle, and with a rufo-piceous knee; fore tibia rufo-lutescent tipped with black; fore tarsus light brown-ochre, with black joinings. Hinder femora (as opaque objects) light olive grey, or (with transmitted light) very light greenish-yellow amber-colour, banded with black-grey in the middle and near their terminations: hinder tibiæ and tarsi light brown-ochreous, their joinings rather dark, and the distal tarsal joint brown. Wings vitreous, with pitch-brown or bistre-brown neuration, excepting the cross veinlets between the costa and sector in the fore wing, which are pitch-black. The fore wing at the roots and in the portion of the submarginal area subtending the pterostigmatic space very light raw-umber, this colour extending further along the margin to just beyond the extremity of the wing; the remainder of the same area of a very much fainter tint: in the area between the radius and the sector, in the vicinage of the bulla, 2 or 3 cross veinlets approximated to one another are intersected by a short intense sepia-brown dash rounded at both its extremities, and 3 or 4 of those nearer the base of the wing are marked each with a rounded spot of the same colour. Terminal margin of the hind wing narrowly bordered with sepia-grey. Length of body, ♀ 7·5, wing 8 mm.

Hab. Canada (Brit. Mus.).

ECDYURUS VERTICIS, Say.

‡ *Baëtis verticis*, Say, Journ. Acad. Nat. Sc. Philad. viii. 42 (1839); Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 562 (1853); Le Conte, Complete Writings of T. Say, ii. 412 (1859); Hag., Smith-

son. Miscell. Coll. (1861) Synop. Neuropt. N. Am. 46; Walsh, Proc. Ent. Soc. Philad. ii. 204 (1863); Etn., Trans. Ent. Soc. London (1871), 121.—*B. flaveola*, Pict., Hist. Nat. Névropt. ii. Ephém. 186, pl. xxiii. 4 (1843–5); ! Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 559 (1853); Hag., Smithson. Miscell. Coll. (1861) Synop. Neuropt. N. Am. 41.

Heptagenia flaveola, ! Etn., Trans. Ent. Soc. London (1871) 119, pl. vi. 22, 22 *a* [detail].

Subimago (*dried*).—Wings very light grey; the longitudinal neuration of the fore wing is, in some lights, concolorous with the membrane, in others pitch-brown; the cross veinlets in the ♀, at first dark grey, afterwards become pitch-black; those before the bulla in the marginal and submarginal areas also become bordered with deep warm sepia-brown; the neuration of the hind wing is concolorous with the membrane. Femora banded in the middle, and again distally more narrowly with dark grey. The whole of the body and legs in the female are chiefly very light yellow-ochreous approaching Naples yellow; the abdominal segments 1–9 bordered distally in the midst of the back with black grey, and in segments 4–6 marked with a small black spot on each side of the back just before the distal border, in place perhaps of the usual oblique stripes.

Imago (*dried*).—♂. Thorax rufo-luteous above. Abdomen in segments 2–7 translucent ochraceous, white with the joinings above bistre-brown; segments 8–10 rufo-luteous above; venter spotless. Setæ whitish-grey, with the joinings scarcely at all darker. Legs sub-stramineous, with dark joinings; every femur with a bistre-brown band in the middle and another distally; the fore tarsus whitish, with dark joinings. Wings vitreous; the fore wing with the neuration mostly black, the costa, subcosta, and radius however, being light translucent testaceous; neuration of the hind wings pellucid.

♀. Head and thorax very light ochraceous; a greyish spot at the lower end of the facial carina, a dark oblique streak at the base of the fore coxa, a black dash in the suture in front of the hind coxa, and another on the hinder surface of the pleura above the coxa. Abdomen (discoloured) of a redder yellow; the segments above narrowly edged with black-grey at the joinings. Setæ whitish-grey, with pitch-brown joinings. Legs extremely light yellow-ochreous; the median and distal bands of the femora dark sepia-brown; the extreme edge of the tibia at its distal termination above, and the terminal joint of the tarsus, and also the ungues, light brown. Wings vitreous; the fore wing tinged very faintly with light dull greenish yellow in the submarginal area as far as the vicinage of the pterostigma from the base of the wing; longitudinal neuration translucent and of a light colour; cross veinlets light bistre-brown, the great cross vein coloured more strongly near the subcosta. The marginal area of the fore wing contains about 4 cross veinlets before, and 11 beyond the bulla; these last are simple. Length of body, ♂ 9, ♀ 8–10; wing, ♂ 10, ♀ 11–13; setæ, ♂ im. 20, ♀ subim. 16 mm.

Hab. St. Martin's Falls, Albany River, Hudson's Bay (Barnston, in Brit. Mus.); West Farms, N.Y. (Angus, in McLach. Mus.); Tennessee (Pœpig), Dalton, Ga. (Osten-Sacken) and Washington (*id.*, in Hag. Mus.).

Ecdyurus luridipennis, Burmeister.

Ephemera noveboracana, Lichtenstein, Cat. Mus. Holthusien, iii. 193 (1796)?

‡ *Baëtis luridipennis*, Burm., Handb. d. Ent. Bd. ii. Abth. ii. 801 (1839); Pict., Hist. Nat. Névropt.

ii. Ephém. 192 (1843–5); ! Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 563 (1853); Hag., Smithson. Miscell. Coll. (1861) Synop. Neuropt. N. Am. 49.—*B. noveboracana, id., op. cit.* 50 (1861)?

Heptagenia luridipennis, ! Etn., Trans. Ent. Soc. London (1871) 149, pl. vi. 21, 21 *a* [detail].

Subimago (*dried*).—Wings transparent, very light bistre-grey; the longitudinal nervures bistre-brown, the cross veinlets pitch-black. Setæ light bistre-brown, with dark joinings.

Imago (*dried*).—♂. Thorax above rufo-testaceous or (in other lights) fusco-lutescent; abdomen in segments 2–7 translucent light burnt-umber brown, opaque at the joinings, and formerly with dark oblique lateral stripes; the hinder segments rather dark bistre-brown. Setæ bistre-grey, with dark joinings. Fore femora and tibiæ subtestaceous, with two dark bands on the femur and the end of the tibia fuscous; fore tarsus light bistre-grey. Hinder legs dull light yellow-ochre, the coxæ, trochanters, and femoral bands, light warm sepia-brown, the apical edges of the tarsal joints, and the ungues brownish. Wings vitreous, slightly discoloured in the pterostigmatic portion of the marginal and submarginal areas; the neuration pitch-brown, excepting the thicker longitudinal nervures near the base, which are there bistre-brown.

♀. Very similar to the ♂. Thorax raw-umber brown above. Legs dull light-yellowish green horn-colour; a band in the middle and at the extremity of the femur, the joinings and the terminal joints of the tarsus, ungues included, warm sepia-brown. The portion of the submarginal area of the fore wing adjacent to the pterostigmatic space is faintly tinted with pale greenish. Length of body 10–11; wing, ♂ 13, ♀ 15; setæ, ♂ 25 (?), ♀ 15 (?) mm.

Hab. St. Martin's Falls, Albany River, Hudson's Bay (Brit. Mus.); the St. Lawrence, Canada (De Selys-Longchamps).

Ecdyurus vicarius, Walker.

‡ *Baëtis vicaria*, ! Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 565 (1853); Hag., Smithson. Miscell. Coll. (1861) Synop. Neuropt. N. Am. 48.—*B. tessellata*, ! Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 566?

‡ *Ephemera pudica*, ! Hag., Smithson. Miscell. Col., Synop. Neuropt. N. Am. 39 (1861).

Heptagenia vicaria, ! Etn., Trans. Ent. Soc. London (1871) 150, pl. vi. 23, 23 *a* [details]:—*nec H.* ‡*pudica*, ! Hag., Ann. Rep. U. S. Geolog. & Geograph. Survey of the Terr. for 1873, part iii. Zool. 581 (1865).

Subimago? (*dried*).—Wings warm sepia-grey; longitudinal neuration yellowish brown; cross veinlets in some parts black-brown, in other parts light sepia-brown, edged narrowly with light sepia-grey, the black-brown or intense sepia colouring spreading along the longitudinal nervures at their junctions with cross veinlets, and causing the nervures to be banded. Setæ bistre-grey, with darker joinings.

Imago (*dried*), ♂.—Notum brown-ochreous, modified with raw-umber brown; an intense black-brown stripe from the fore wing roots on each side of the mesothorax. Dorsum of the abdomen in segments 2–9 light pitch-brown, in segment 10 brown-ochreous; on the dorsum and venter, by the spiracles, are translucent figure-of-6-shaped marks, and at the base of every intermediate dorsal segment is a pair of short pale longitudinal lines. Setæ bistre-brown with dark joinings. Fore femur, in opaque view, light bistre-brown, banded broadly in the middle and narrowly at the tip with pitch-brown; tibia rather a redder raw-umber than the femur, brown-black at the tip; tarsus light

warm sepia-brown. Hinder femora, in opaque view, testaceous or very light brown-ochreous, banded broadly in the middle and rather broadly at the tip with brown-black; tibiæ brown-ochreous; tarsi brown-black. Wings vitreous, tinged in the pterostigmatic region of the fore wing with light bistre-grey; neuration either pitch-brown or very dark rufo-piceous; the cross veinlets interjacent between the fore costa and the pobrachial (7) are most of them slightly thickened, and those of the pterostigmatic space are simple and straight.

♀. Similar to ♂. Length of body, ♂ 12; wing, ♂ 13, ♀ 14·5–18; setæ, ♂ 35 mm.

Hab. The St. Lawrence (Walker); Chicago and Washington (Hagen); Savannah (Osten-Sacken). I did not compare the subimagines described respectively by Hagen and Walker; and have only quite lately come to consider them to be of one species.

EUROPEAN AND ASIATIC SPECIES.

* *Penis-lobes broadly expanded outwards at the tips.*

Ecdyurus Krueperi, Stein.

‡ *Potamanthus Krueperi*, Stein, Berlin. ent. Zeit. vii. 114 (1863).
? *Leptophlebia Krueperi*, Etn., Trans. Ent. Soc. London (1871) 86.
‡ *Baëtis Krueperi*, Stein MS., Etn., *op. cit.* (1873) 395.

Imago (*dried*), ♂.—Notum dark pitch-brown, approaching intense burnt-umber. Dorsum of abdomen bright brown-ochre, approaching in some lights Mars-yellow; the joinings of the segments appear slightly opaque, and oblique dark lateral stripes of the ordinary description are faintly indicated in segments 2–7 or –8 [the specimens described are aged and doubtless faded]; the ventral nerve-ganglia are visible. Setæ whitish brown-ochre, browner towards the roots; their joinings light pitch-brown and, in the lighter portion, alternately narrow and broad. Fore leg, in opaque view, pitch-brown. Hinder femora, in opaque view, light raw-umber brown, the tibiæ rather lighter, the tarsi, in some lights, nearly concolorous with the femora. Fore wings vitreous, tinted faintly throughout the disk with whitish raw-umber, but more distinctly tinged with light raw-umber at the roots and in the marginal and submarginal areas, and especially so at the commencement of the pterostigmatic space; the cross veinlets of this space are branched, and anastomose evenly with one another. Hind wing conspicuously tinged with light raw-umber brown, darkest towards the terminal margin. Wing-neuration, in opaque view, for the most part pitch-brown; but the near extremities of the longitudinal nervures posterior to the radius (3) in both wings, the whole of the costa of the hind wing, and the extreme base of the costa in the fore wing are light raw-umber.

♀. Notum dark brown-ochre. Abdomen discoloured; the oblique stripes at the sides of the segments are piceous, and the spaces below them are of a light colour. Setæ defective, piceous at the base, with opaque joinings. Legs similar to those of ♂ in colour, but with the hinder tibiæ darker. Fore wing very similar to that of the ♂, but less distinctly discoloured along the costa. Hind wing as nearly colourless as the fore

wing throughout, excepting only the neuration. Ventral lobe of segment 9 ellipsoidally rounded off. Length of body 10–11; wing, ♂ 12–14, ♀ 14 mm.; setæ defective.

Hab. Greece (Stein, in Berlin Mus.); Albania (Sir S. Saunders), 2 ♂, 1 ♀ im. (in M'Lach. Mus.).

Part V. Read November 18th, 1886.

I FIND myself unable to decide, from dried specimens, whether *E. helveticus*, *venosus*, and *forcipula* are entitled to rank as species only or as races. It is possible, if specimens were grouped in accordance with their style of coloration, that *E. forcipula* might justly be held to bear the same kind of relationship towards *E. helveticus*, as the var. *quæsitor* to *E. venosus*, and that the peculiar shortness of the first joint of the ♂ fore tarsus of *E. helveticus* may be found to be something less than a specific distinction. On the 3rd of June, 1885, I captured two ♂ imagines of *E. venosus* by the river at Eden Lacy in Cumberland, having the tarsal joint in question perceptibly shorter proportionally than that joint is in any other specimens caught elsewhere, or at other times in the same place, during that year. Specimens of *E. venosus* that have been relaxed and set out for the cabinet after they have become dry in the first instance are very apt to lose their markings and to be rendered unserviceable for study; and I have consequently found it difficult to institute comparisons between the unset specimens in my own collection, and a large proportion of those from other collections submitted to me for identification.

ECDYURUS HELVETICUS, sp. nov. Plate XXIV. 16 *a* (♂ fore tarsus).

‡ *Baëtis* ‡ *venosus*, Pict., Hist. Nat. Névropt. ii. Ephém. 167, pl. xx. [part.] (1843–5).

Subimago (*living*).—Wing-membrane either fumatose or dusky, tinged at the base of the fore costa and again beyond the middle with bright or sulphur-yellow, but elsewhere in the basal half of the same with dull greenish, approaching olive-green; fore wing marked with the usual dark stripes; terminal margin of the hind wing broadly bordered with dark grey. Eyes of ♂ dull yellowish green, traversed by a reddish-brown line, and displaying a movable black spot; those of ♀ dark and dull olivaceous. Fore femur of ♂ pitch-brown; tibia rather lighter; hinder femora dull greenish grey or olivaceous; tarsi black; setæ pitch-black; forceps black.

Imago (*dried*), ♂.—Notum light brownish or pitch-brown. Fore leg of ♂ uniformly piceous, with the first tarsal joint short for an *Ecdyurus*. Pterostigmatic space of the fore wing darkened. Abdomen nearly uniformly brownish above, with the following exceptions:—*in transmitted light* on each side of the base in segments 2–7 a small colourless translucent narrow space or spot, rounded below, extends nearly to the anterior dorsal trachea of the segment; and between the two dorsal tracheæ of the segment, the shallow, oval depression (covered in the nymph by the tracheal branchiæ) is rather paler than its borders.—(*Living*). Eyes sometimes intense bistre or pitch-brown above, sometimes rich rufo-fuscous, and traversed below by a dark or rusty line edged with ligh

greenish or yellowish; they also exhibit a movable black spot. Notum either testaceo-piceous or pitch-black. Dorsum of abdomen either dark bistre-brown or rufo-piceous, with the terminal borders of the segments opaque, having, however, their extreme edges sometimes pale, and with small translucent markings at the bases of some of the segments, similar to those already described in dried specimens. Venter sometimes uniformly dark warm-sepia, sometimes a rather yellower brown with paler joinings; segment 9 tinged with dull orange, and edged at the extreme base and at the sides with pitch-black; a pair of abbreviated divergent black lines is apparent at the base of the segment in segments 2–8, and the nerve-ganglia are visibly darkened in segments 4–7. Forceps-basis olive-black; the limbs black, each with a whitish spot inside at the base of the penultimate joint, and with the terminal joint white inside. Setæ pitch-black at the base, becoming distally light dusky grey with darker joinings. Fore legs pitch-black, with the femora lighter towards the base, and with the tarsal incisures whitish beneath. Hinder femora light olivaceous, tinged with bistre towards the knee; tibiæ light olivaceous, tinged with smoke-grey distally, [with change of light a yellowish tint predominates over the olive]; tarsi pitch-black, with the joinings pale beneath. Wings vitreous; the fore wing often tinted conspicuously towards the roots and in the marginal and submarginal areas with dull greenish yellow, or with yellowish green, and blackened or dark grey in the pterostigmatic region; neuration for the most part pitch-black, excepting that the stronger nervures in the disk are tinged with fuscous, and become near the roots olivaceous or flavo-piceous.

♀ (*dried*).—Very similar to *E. venosus* ♀. Length of body 10–13·5; wing, ♂ 12–13, ♀ 13–15: setæ, ♂ im. 25–35, subim. 15, ♀ im. 21, subim. 14 mm.

Hab. Alpine Switzerland, N. Italy and Savoy, chiefly at altitudes of over 2000 ft. Common in July and August at the following localities:—the head-waters of the Dranse de Biot near the Charbonnière at 4800 ft., and (in the same neighbourhood) both near the Châlets de Jouplane, Samoëns, at 5100 ft., and near Bonavaux, Champéry, at 5400 ft.; also in Val Furva near Bormio at 6300 ft., and in the neighbouring Mt. Adamello district. Streams and torrents ranging in temperature at the stated season from 50° to 62° F. seem to be the most suitable for the species, although it may sometimes be met with where the temperature of the water in the morning is as low as 46° F., or as high in the afternoon as 68° F. Mr. M'Lachlan captured several specimens of this species near Interlaken in the Habkern Thal, on the 21st of August; and I am disposed to identify with it a specimen captured by me in the Apennino Pistojese, at 4200–5200 ft., in the Valle Sestajone.

Ecdyurus venosus, Fabricius. *Adult*, Pl. XXIII. 46 (hind wing); Pl. XXIV. 46 (legs and genitalia). *Nymph*, Pl. LXII.

Ephemera venosa, Fabr., Syst. Ent. 304 (1775); *id.*, Sp. Ins. i. 384 (1782); *id.*, Mant. Ins. i. 243 (1787); Gmel., Linn. Syst. Nat. ed. 13, i. pars v. 2629 (1790); Ol., Encycl. Méth. vi. 418 (1791); Fabr., Ent. Syst. iii. pars i. 70 (1793); Lat., Hist. Nat. d. Crust. et Ins. xiii. 97 (1805).—*E. berolinensis*, Müll., Zool. Dan. Prodr. 113 note (1776) ?—*E. fusco-grisea*, Retz., C. de G. Gen. et Sp. Ins. no. 183 (1783) ?—*E. nervosa*, Vill., C. Linn. Ent. iii. 22 (1789).—*E. nigrimana*, Dufour, Mém. par divers sav., Instit. de France, viii. 580 footnote (1841) ?—*E. rufa*, Ramb., Hist. Nat. d. Ins. Névropt. 269 (1842).

‡ *Baëtis dispar*, Curt., Lond. & Edinb. Phil. Mag. ser. 3 (1834) 120; *id.*, Brit. Ent. xi. 484 (1834); ! Steph., Ill. Brit. Ent. vi. 63 (1835).—*B. venosa*, *id.*, *op. cit.*, *l. c.*; Burm., Handb. d. Ent., Bd. ii. Abth. ii. 801 (1839); Walk., List of Neurop. Ins. in Brit. Mus. part iii. 556 (1853); Pictet, Hist. Nat. d. Ins. Névropt. ii. Ephém. 167 [part.] (1843–5); Brauer, Neurop. Austr. 26 (1857); Hag., Ent. Ann. (1863) 22; Karsch, Die Insectenwelt, v. 400–2 (1863).—*B. subfusca*, ! Steph., Ill. Brit. Ent. vi. 64 (1835); Pict., Hist. Nat. Névropt. ii. Ephém. 194 (1843–45); Walk., List &c. part iii. 561 (1853).—*B. purpurascens*, Pict., Hist. Nat. Névropt. ii. Ephém. 174, pl. xx. 4 (1843–5); Walk., List &c. part iii. 557 (1853); Brauer, Neuropt. Austr. 26 (1857); Ausser., Ann. d. Soc. Natur. Modena, An. iv. 135 (1869); [??] Moesáry, Rev. d. Inhaltes der Természetrajze, Fuzetek ii. 124–5, or [German text] Naturh. Hefte ii. Bd. ii. u. iii. 181–2 (1878) ?—*B.* ‡ *longicauda*, ! Ronalds, Fly-fisher's Ent. ed. 5, pl. ix. (1856).—*B.* ‡ *montana*, Hag., Ent. Ann. (1863) 26 [part].—*B. Picteti*, Meyer-Dür, Mitth. schw. ent. Ges. i. 121 (1864).

Ecdyurus venosus, ! Etn., Trans. Ent. Soc. London (1868) 142 note [misspelt *Ecdyonurus*]; ! *id.*, Ent. Mo. Mag. xviii. 25 [nymph] (1881).—*E. quæsitor*, ! *id.* MS., in the writing of Pl. XXIV. 46*b* [penis] (1883).

Heptagenia venosa, ! Etn., Ent. Mo. Mag. v. 90 (1868); *id.*, Trans. Ent. Soc. Lond. (1871) 151 [part] pl. vi. 24 [genitalia]; Hag., *op. cit.* (1873) 104–5; ! Meyer-Dür, Bull. Soc. Ent. Suisse, iv. 314 (1874); Rostock, Jahresb. d. Ver. f. Naturk. Zwickau, 1877, p. 92 (1878); Palmén, Paar. Ausf.-Gänge d. Gesehl. Org. b. Insect. SS. 40, 44, 47–48, 51, 65–6, 69, 70, 74, 76–80 & 92, taf. iv. 57, 59, 68, & taf. v. 93 [anatom.] (1884).—*H. nigrimana*, Etn., Trans. Ent. Soc. London (1871) 144?—*H.* ‡ *longicauda*, ! *id.*, *op. cit.* (1871) 152, pl. vi. 25 [genitalia].—*H. Picteti*, *id.*, *op. cit.* (1871) 153.—*H. purpurascens*, ! Meyer-Dür, Bull. Soc. Ent. Suisse, iv. 135 (1874).

Subimago (*living*).—Wing-membrane either very light ivory-black-grey, or very light fawn or Cologne-earth grey, with the borders of the cross veinlets narrowly darker. Before the moult, dark transverse stripes and bands appear in the wings, similar to those described under *Heptagenia sulphurea*. A greenish-yellow tint usually pervades the pterostigmatic space, and is sometimes diffused about the base of the fore wing. Fore femur piceous or olive-grey; hinder femora olivaceous; tibiæ grey or black-grey; tarsi black. Setæ pitch-black. (*Dried.*)—The wings vary in appearance according to the period at which the specimen is killed, as follows:—1st, wings uniformly light sepia-grey, with the cross-veinlets and most of the longitudinal nervures (*i. e.* all but the stronger nervures) rather a darker grey, and equal to each other in definition; 2nd, the cross-veinlets become bordered with grey, and hence the longitudinal neuration becomes less obvious to the naked eye; 3rd, the colouring-matter of the wing-membrane appears to become concentrated in the immediate neighbourhood of the cross-veinlets, so as to produce dark transverse bands, leaving the spaces where cross-veinlets are scarce paler than the other parts. The wings of some specimens might be described as of a dark colour with pale transverse stripes and bands, instead of *vice versâ*, light with dark markings.

Imago (*dried*).—Notum of ♂ pitch-brown, sometimes approaching pitch-black; that of ♀ lighter, sometimes brown-ochre or ferruginous brown. Fore leg of ♂ uniformly pitch-brown, excepting that sometimes the femur is lighter just at the base; 1st tarsal joint of normal length. Pterostigmatic space usually more or less obscured, sometimes clear. Terminal margins of the intermediate abdominal segments dark, excepting at the pleuræ; dorsal segments 2–8 marked, on both sides, either with a dark triangle, or

(through the obtuse angle and lower edge of the triangle being deficient in dark pigment) with a broad oblique dark stripe enclosing near the posterior angle of the segment a small pale space.— ♂ (*living*). Eyes either intense sepia-brown, traversed below by a dark line edged with light yellowish or greenish grey; or pitch-brown traversed by a dark line. Frons piceous; epistoma olive-grey or black. Notum at first bistre-brown, changing to intense pitch-brown, or even to pitch-black; a stripe in advance of the wing-roots is either dull orange varied with light greenish yellow, or else subochraceous or Mars-yellow. Dorsum of abdomen either light raw-umber-brown, or greyish bistre-brown in the middle, and dull light yellowish or greenish at the sides of segments 2–6 [in the hinder segments more of the former tint], with the apical borders of the segments dark or piceous (excepting at the pleuræ), and marked on both sides of each segment with either a triangle or an oblique stripe of a reddish-brown or burnt-umber colour. When there are stripes, each stripe tapers forward from a rather broad base at the hind margin to the spiracle: the stripes in segments 7 and 8 are broader than in the anterior segments, and each subtends a dull light yellowish triangular spot in the hinder angle of the dorsum; this spot is almost effaced by the stripe in segment 9. The pleuræ throughout the abdomen and the sides of the dorsum of segment 10 in front of the insertions of the setæ are of a similar pale colour. Venter in segments 1–6 either light bistre-brown, olive-brown, or olive-grey, becoming posteriorly more and more of a light brownish ochre or dull orange; the impressed dots and dashes are not usually dark-coloured like those of *E. insignis*. Setæ and forceps-limbs piceous. Fore femur dark bistre-brown, paler at the base; tibia and tarsus in some lights pitch-black. Hinder femora either light brownish olive, light bistre, or fusco-luteous, but pitch-brown just at the knee; tibiæ in some positions lighter than the femora, or even testaceous; tarsi in some lights blackish grey some or greyish black, in others pitch-black or intense sepia-brown. Wings vitreous, sometimes colourless, but often tinged faintly with greenish or yellowish green in the basal half of the disk and in the greater portion of the marginal and submarginal areas of the fore wing, and usually blackened or obscured with intense sepia-brown in the pterostigmatic space. Neuration pitch-black, the basal extremities of the stronger nervures lighter in some positions; in living specimens the bullæ are pale.

♀ (*living*).—Very similar to the ♂ but lighter. Notum bistre or light pitch-brown; *when dried* brown-ochre or ferruginous brown. The dorsal tracheæ outside the abdominal stripes are dark. The pterostigmatic space of the fore wing is usually very slightly, if at all, discoloured, and is seldom so dark as it commonly is in the other sex; neuration often pitch-brown in small specimens. Head often dull orange, with the surroundings of the ocelli and a spot on the occipital margin pitch-brown, and with the epistoma olive-grey; eyes intense sepia-brown. Length of body, ♂ 10–15, ♀ 10–18; wing, ♂ 11–15, ♀ 11–18; setæ, ♂ im. 22–48, ♀ im. 14–25, subim. 12–17 mm.

Hab. Generally distributed from Lapland and Finmark southwards. Common in Great Britain from June to September. Specimens of medium size are found in Switzerland and the adjoining districts at moderate altitudes, *e. g.*, at Gex and Berne (M'Lach.); also near Samoëns at 2200 ft., and near Bannio, Val Anzasca, at 3000 ft., and near Fontana, Val Bavona, not far from Bignasco, at about 2000 ft. Similar specimens have

been also taken in France at Autun, by McLachlan ; some captured by him near St. Moritz (Grisons) on the 12th August, and in Val Bedretta, 17th August, are unusually large. In the Basses-Pyrénées it occurs near Laruns and Eaux Chaudes at about 1800–2000 ft. I am inclined now to consider *E. quæsitor*, Etn., MS., to be only a local form of this species; but for fear of possible error I subjoin a description of the living insect.

Variation ? [*quæsitor*]. *Imago* (*living*), ♂.—Eyes dark pitch-brown or intense sepia, traversed by a deep umber-brown line edged with light yellowish. Notum rufo-piceous; *when dried* light pitch-brown. Dorsum of abdomen rich reddish purple-brown, bordered with pitch-brown at the hind margins of the segments 2–9, between the ends of the oblique lateral stripes, which themselves are of a red-purple tint and cut off triangular spaces of a lighter red-purplish tint; pleuræ light yellow; spiracular spots black; segment 10 is of the pale ground-colour. Venter anteriorly light burnt-umber brown; segments 8 and 9 rubiginose with dark joinings. Setæ light sepia-brown with dark joinings, becoming pitch-black at the roots. Fore femur dark pitch-brown; tibia and tarsus pitch-black. Hinder femora greenish grey or light olivaceous, brownish at the tips, their tracheæ finely irrorated with black; tibiæ tinged with light yellow-ochre; tarsi black. Wings vitreous, tinged faintly with greenish in the marginal and submarginal areas before the middle, and also in the pterostigmatic space; neuration pitch-black, lighter at the wing-roots.

♀ (*living*).—Eyes dull olivaceous, mottled outside with pitch-brown or burnt-sienna, and traversed by a line of the same colour. Notum pitch-brown. The triangular lateral markings of the dorsal segments of the abdomen are dark burnt-carmine, and the lighter parts are more rosy than in the other sex. Setæ towards the roots deep warm sepia-brown, becoming distally light warm sepia-grey with dark joinings. Length of body 11; wing, ♂ 12–13, ♀ 15; setæ, ♂ im. 31–40, ♀ im. 25 mm.

Hab. The Apennino Pistojese at the Limestre near Villa Margherita, San Marcello, at the end of July, at an altitude of 2160 ft. The males, after 6 P.M., were caught on the wing whilst flying in a very peculiar manner about the tops of alder trees (*Alnus*), about 20 ft. from the ground. Their movements resembled somewhat those of *Rhizotrogus* ♂ in quest of a female—whence the name *quæsitor*. Earlier in the day specimens were obtained by beating.

Ecdyurus forcipula, Kollar, MS. Plate XXIV. 46 *c* (penis).

‡ *Baëtis forcipula*, Kollar, MS., Pict., Hist. Nat. Névropt. ii. Ephém. 169–170 note (1843–5).

Heptagenia ‡ *alpicola*, ! Etn., Trans. Ent. Soc. London (1871) 148, pl. vi. 19 [penis dried; Carinthian specimens only].—*H. forcipula*, *id.*, *op. cit.* (1871) 152 [undescribed]; Meyer-Dür, Mitth. schw. ent. Ges. iv. 314 (1874); ! Rostock, Jahresb. d. Ver. f. Naturk. Zwickau, 1877, p. 91 (1878).

Ecdyurus italicus, ! Etn., MS., in the writing of Pl. XXIV. 6 of the present work (1883).—*E. Zelleri*, ! *id.* MS., p. 239 *supra* in bibliography of *Epeorus alpicola* (1885).

Subimago (*living*).—Wings uniformly black-grey, slightly tinged with greenish in the marginal area towards the base and at the tegulæ. Eyes olive-green above, and rather a light reddish brown by their lower orbits, with a red-brown line intervening between these two colours. Fore leg pitch-brown; hinder femora and tibiæ brownish olive with dull black tarsi. Setæ pitch-black.

Imago (*dried*), ♂.—Notum brownish ochre or reddish brown, sometimes darker behind. Fore leg in opaque view uniformly piceous; 1st tarsal joint of normal length. Pterostigmatic portion of the marginal area of the fore wing darkened more or less. Abdomen, *in opaque view*, usually marked at the sides with dark triangular spots, each occupying the lower half of the flank of the dorsum, but leaving the pleuræ pale; *in transmitted light* the spiracles become translucent, and a pale obovate space appears inside each of the dark triangles above the pleuræ. In diseased specimens, such as are infested with internal parasites, the dorsum is commonly of a uniformly dark colour, with opaque joinings, excepting that in segments 4–7 the extreme bases of the segments on each side may be narrowly translucent. (*Living.*)—Upper portion of the eyes either greenish bistre-brown, or olive-green; a burnt-umber-brown line, edged above with bright yellow separates this portion from a narrow greenish fuscous stripe along the lower orbit. Thorax pitch-brown above, darker behind. Abdomen red-purple-brown above, with the joinings of the segments opaque in the midst, and pale at the pleuræ, and sometimes with scarcely any indications of the usual dorso-lateral triangular markings; venter spotless, paler than the dorsum, and tinged in segment 9 with orange. Forceps black. Setæ dull black at the base, but sepia-grey with dark joinings nearer their extremities. Fore leg pitch-black, with the trochanter rufo-piceous. Hinder femora dull light olive-grey, slightly tinged at the edges and about the knee with rufo-piceous; tibiæ darker olive-grey; tarsi dull brownish black. Wings vitreous; marginal area of the fore wing tinged slightly for some distance from the roots with greenish yellow, and in the pterostigmatic region with light blackish grey; neuration piceous, pale at the roots; tegulæ bright yellowish.

♀ very similar. Length of body 9–12; wing 10–13; setæ ♂ im. 22–31, subim. 16, ♀ im. 21 mm.

Hab. Continental Europe from Saxony southwards to Central Italy. Common in Val Anzasca near Ponte Grande at 1350 ft., 19th July; also in the Apennino Pistojese, both near San Marcello by the Limestre and its tributaries in the chestnut-wood below Gavanina at 2150–2750 ft., and also in the Valle Sestajone at 4230 ft. [2nd August, 11 A.M., water 50° F.]. Specimens captured by Prof. Zeller in Carinthia during June 1867 are in M'Lach. Mus., and being faded through damp and age, were until recently mistaken by me for a distinct species. I had (prior to inspecting specimens named by Rostock in Albarda Mus.) always supposed the species named *forcipula* by the Swiss entomologists to be identical with *Ecdyurus fluminum*—a view that might be contended for; but, adopting Herr Rostock's application of the name, I now give precedence to *forcipula* over *italicus*.

Ecdyurus Bellieri, Hagen.

‡ *Baëtis Bellieri*, ! Hag., Ann. Soc. Ent. Fr. (1860) 746.
Heptagenia Bellieri, ! Etn., Trans. Ent. Soc. London (1871) 154.

Imago (*dried*), ♀.—Wings vitreous, with piceous neuration, and with the pterostigmatic region of the fore wing darkened. Fore legs piceous; hinder legs testaceous with fuscous tarsi. Setæ piceous. Ventral lobe of the 9th abdominal segment entire. Length of wing 14 mm.

Hab. Sicily. Somewhat similar in colour to *H. montana*, according to Hagen. The lacteous tint of the wing-membrane might be due to camphor. The type was examined by me in 1869; but I have no recollection of the insect.

Ecdyurus insignis, Etn. Plate XXIV. 46 *d* (penis).

Ephemera, ! Ronalds, Fly-fisher's Ent. ed. 1, pl. xi. 22 (1836).

Heptagenia insignis, ! Etn., Trans. Ent. Soc. London (1870) 7; ! *id., op. cit.* (1871) 153, pl. vi. 26, 26 *b* [detail]; Palmén, Paar. Ausf.-Gänge d. geschl.-Org. b. Insect. S. 74, 77, 78 [anatom.] (1884).

Subimago (*living*).—Wings light sepia-grey, the cross-veinlets narrowly edged with darker grey; longitudinal nervures subolivaceous or dark greenish grey in the greater portion of the wing, the wing-roots, and sometimes the adjoining parts of the said nervures, light olive-green or greenish yellow; cross-veinlets black. Setæ and hinder tarsi black.

Imago (*living*), ♂.—Eyes either dark olive-green intersected by an olive-brown line and exhibiting a large dark round movable spot, or else greenish black or black, their predominant colour changing with age or the time of day. Notum in front either very dark bottle-green or bistre-brown, posteriorly black varied with yellowish brown, or with brown-ochre or dull orange; tegulæ light greenish yellow. Abdomen whitish green, [the "green" approaching green oxide of chromium] modified in segments 8 and 9 with brown-ochre above, with yellow-ochre in segment 10, and marked with black in segments 1–8 above and beneath; the dorsal markings in each of these segments are an oblique streak descending from the hind margin to the pleuron, in close proximity to the anterior lateral angle of the dorsum on each side, tapering downwards and narrowly cuneiform, and these two streaks are connected together by a very narrow black edging along the interjacent portion of the terminal margin of the segment; in ♀ the tract of the dorsal vessel is likewise blackish: the ventral markings in segments 1–7 comprise, severally, a short acute longitudinal streak ♂ (or triangular spot ♀) from the base in the middle, a pair of short isolated lines parallel with the dorsal streaks of the same segment, commencing at a short distance from the median streak a little before its point, and divergent from each other backwards, a pair of dots placed transversely adjacent to the ganglionic tract, a little to the rear of the ends of the divergent lines, and, lastly, a fine line on each side closely skirting the pleuron, terminating some distance from the tip of the segment, and interrupted a little before the middle; in segments 8 and 9, the olive-green ground-colour is suffused more or less with reddish brown in ♂, and is varied in ♀ with pitch-brown. Setæ pitch-brown at the base, passing into intense sepia-brown and distally into warm sepia. Fore femur and tibia pitch-brown, the tarsus rather lighter in some positions; in immature specimens the femur is dark olive-brown approaching bistre, and is blackish at the knee; hinder femora light olive-green modified with bistre, the latter colour predominating at the knee and along the upper and lower edges; tibiæ paler than the femora; tarsi blackish or ivory-black. Wings vitreous; in the fore wing the longitudinal neuration and sometimes most of the cross-veinlets in the pterostigmatic space are dull olivaceous (excepting the bases of the nervures posterior to the subcosta, which are whitish), and the remaining cross-veinlets are black; a small blackish cloud is

also noticeable in the pterostigmatic region of that wing, situated at about $\frac{2}{5}$ of the distance from the bullæ towards the apex of the marginal area, between the costa and the radius: in the hind wing the neuration appears whitish in some lights, in others the cross-veinlets towards the extremity of the wing become greyish.

♀ (*living*).—Eyes brownish olive. Pronotum greenish olive; mesonotum light olive-brown; metanotum blackish, varied with light and brownish ochre. Abdomen light greenish olive, with a dark narrow median stripe along the back in segments 2–7, which is dilated anteriorly in every segment, in addition to the other blackish markings described in the ♂. Setæ intense sepia-brown at the base, becoming lighter with dark joinings distally. In other respects very similar to the ♂. Length of body 10–14; wing, ♂ 10-12, ♀ 12–15; setæ ♂ im. 32–34, subim. 14–20, ♀ im. 22–25, subim. 15 mm.

Hab. England, in rapid parts of rivers, such as the Dart, the Kennet, and the Eden; May to August; France, in the Garonne, close to St. Michel, Toulouse.

Ecdyurus fluminum, Pictet. *Nymph*, Plate LXII. (part).

? *Ephemera speciosa*, Poda, Ins. Mus. Græc. 98 (1761); Schr., Enumer. Ins. Austr. indig. no. 604 (1781); Vill., C. Linn. Ent. iii. 22 (1789); Ol., Encycl. Méth. vi. 418 (1791); Lat., Hist. Nat. d. Crust. et Ins. xiii. 97 (1805).—*E.* ‡ *bioculata*, Panzer, in Explic. Schæf. Ic. ccxxix. [excl. var.] (1804).—‡ *E. angustipennis*, ! Ramb., Hist. Nat. des Ins. Névropt. 295 (1842); Walk., List of Neuropt. Ins. in Brit. Mus., part iii. 571 (1853) [nomen ineptum].

‡ *Baëtis fluminum*, Pict., Hist. Nat. Névropt. ii. Ephém. 164, pls. xvi.–xix. (1843–5); Imhoff, Insect. d. Schw. Bd. iv. [a pl. & fig., not numbered] (1845); Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 556 (1853); Brauer, Neuropt. Austr. 26 (1857); Karsch, Die Insectenwelt, v. 400–402 (1863); Hag., Ann. Soc. Ent. Fr. (1864) 38; Meyer-Dür, Mitth. schw. ent. Ges. i. 221 (1864); Ausser., Ann. d. Soc. Natur. Modena, An. iv. 134 (1869).—*B. angustipennis*, Ed. Pict., Névropt. d'Espagne 23 (1865). —? *B. speciosus*, Etn., Trans. Ent. Soc. London (1871) 120 note; *id., op. cit.* (1873) 402.

Heptagenia fluminum, Etn., Trans. Ent. Soc. London (1871) 146; Meyer-Dür, Mitth. schw. ent. Ges. iv. 315 (1874); Rostock, Jahresb. d. Ver. f. Naturk. Zwickau, 1877, p. 91 (1878); Palmén, Paar. Ausf.-Gänge d. Geschl.-Org. b. Insect. SS. 40, 60, 63, 65, 74 and 77, taf. iii. 38, and taf. iv. 56 (1884) [anatom.].—*H. angustipennis*, ! Etn., Trans. Ent. Soc. London (1871) 152.

Subimago (*dried*).—Wings fawn-colour or light brownish grey, approaching vandyke- and Cologne-earth; neuration for the most part pitch-black, but some of the thicker nervures are yellowish; cross-veinlets black, narrowly edged with grey, rather paler towards the costa. Setæ either light yellowish, or else dark sepia-brown with dark joinings; in living specimens they are blackish grey or dusky. Pictet's figure well represents the wings of the living insect; after death the dark bands and stripes across the fore wing disappear. These markings are as follows:—a transverse cloud in the basal portion of the disk, followed by a transverse abbreviated streak from the anal angle, and another a little further on from the costa in the neighbourhood of the bullæ, and lastly, between this and the tip of the fore wing, three narrow transverse streaks from the pterostigmatic region. (*Living.*)—Eyes of ♀ greenish, surrounded with pitch-brown, and exhibiting a movable black dot. Wings fawn-colour or smoky grey with black, grey-margined cross-veinlets, rather paler towards the costa. Body more or less greenish ochraceous; the abdominal segments very narrowly darker at the tips; segments 1–8 striped obliquely

with black at the sides; the first and the last of the stripes are less distinct than the others. Fore femur intense olive-brown, darker towards the tip and at the edges; tibia blackish grey; tarsus black. Hinder legs light greenish or olive-grey, with black tarsi.

Imago (*living*), ♂.—Eyes at first either intense sepia-brown, intersected below by a transverse sulphureous line; or else warm sepia, divided by a light greenish line; in moribund aged specimens they often become cæsious. (*Dried*) [*dark specimens*].—Notum rufo-piceous or dark reddish brown; a piceous or black stripe extends from the tegulæ to the fore coxa. Dorsum of abdomen broadly red-purple-brown along the middle, with the tract of the dorsal vessel and a considerable portion of the hinder part of each of the intermediate segments slightly darker; in segments 2–8 the sides of the dorsum are light yellowish ochre, intersected obliquely by reddish-purple stripes, extending in each segment from the pale stigmata or spiracles to the hind margin, and emitting a short streak from the spiracle along the main trachea to the nymphal tracheal scar of the preceding segment; hence the sides of the abdomen may be described as striped alternately with reddish purple and light yellowish ochre, the latter colour occupying the hinder angles of the dorsum, and a space on each side of the base above the dark stripes in each of the segments specified. The dark stripes referred to are gradually dilated posteriorly from in front, and their width varies somewhat with the individual; whence the light spaces above the stripes at the bases of the segments vary also in form, being in some specimens ovate or triangular spots, but in others very narrow streaks. The hinder segments are more largely occupied by the dark colouring; but the tenth is almost wholly reddish purple. Venter spotless, either light yellowish ochre in segments 1–6 and in the forceps-basis, but tinged with reddish purple in the remaining segments; or else tinged more or less with reddish purple throughout. Setæ whitish, tinged with sepia near the roots; the joinings piceous, and only for a short distance near the base alternately narrow and broader. Fore femur and tibia pitch-brown; tarsus very light bistre-brown. Hinder legs light yellowish-amber, with the ungues and part of the terminal joint of the tarsus intense sepia-brown, and with some brownish discoloration close to the knee. Wings vitreous, almost imperceptibly tinged with bistre-grey in the marginal and submarginal areas of the fore wing; the pterostigmatic space is as clear as the rest of the area; neuration in most lights pitch-black or black, with the costa, subcosta, and radius of the fore wing pitch- or bistre-brown; the great cross vein in most positions remains black. Pterostigmatic cross-veinlets branched and anastomosing.

Variation [*light specimens* (*dried*)], ♂.—Notum rich brown-ochre. Dorsum of abdomen to a large extent in segments 2–6 or 7 translucent pale bistre-brown, inclining to olive-brown, with the joinings also to a large extent slightly opaque. The sides of the dorsum are rather paler than the midst, but are not strongly contrasted in colour with it; the lateral stripes are black, and do not reach the hind margins of the segments in all specimens, but only in some. Hence the sides of the dorsum do not appear to be striped alternately with a light and a dark colour, but only display dark stripes on a light ground. Fore femur bistre-brown, darker towards the knee.

♀ (*dried*).—Rather similar to ♂, but the notum is lighter. Fore leg bistre-brown, dark at the tip of the femur: in many positions the tibia and tarsus appear as dark as the

femur. Hinder legs sometimes of a somewhat browner yellow amber-colour than in the other sex; the femora rather dark towards the tip; tarsi in small specimens pale, with dark joinings, but in large specimens usually intense sepia-brown or black; basis of subcosta and radius, and great cross vein of hind wing dark; but the nervures themselves light yellowish; ungues black. Setæ *during life* smoke-grey with rufescent joinings; *when dried* their prevailing colour is sometimes warm sepia-brown. The proportions of the tarsal joints, the less obtuse apex of the ventral lobe of the 9th abdominal segment, and the branched and anastomosing pterostigmatic cross-veinlets of the fore wing, serve to distinguish the ♀ of *H. angustipennis* from *Epeorus torrentium*. Length of body, ♂ 8–11, ♀ 9–12; wing, ♂ 9–12, ♀ 9–14; setæ, ♂ im. 19–23, subim. 13, ♀ im. 15–22, subim. 11–13 mm.

Hab. Continental Europe from Norway (Wallengren) to Spain (Ramb.). Common generally at rivers and lakes, from at least July to September, and doubtless earlier. Amongst other localities it occurs in Holland at Arnheim; in Switzerland in the environs of Geneva and Lac Leman at Genthod, as well as at Basle and Berne; in Savoy at Annecy, Chambéry, Aix-les-Bains, and Evian (M'Lach.); in Northern France at Fontainebleau (*id.*); in Southern France at Toulouse and Tarascon [Ariège]; and at Madrid (Ramb.). At the Berne Museum in 1879 Albert Müller showed me the original drawings for Imhoff's plate (1845). The ♂ oculi are rightly represented in the artist's original drawing as warm sepia-brown, intersected horizontally by a 'gramineous' line. In the revised copy adopted as the original of the published figure the eyes were coloured 'gramineous' entirely. Pictet made them 'cyaneous'—a very light shade of ultramarine, or an intense ultra ash-blue. His specimens may have been moribund or flaccid with age, or he may have coloured them after the eyes of a subimago.

Ecdyurus volitans, Etn.

Heptagenia volitans, ! Etn., Trans. Ent. Soc. London (1870) 7; ! *id., op. cit.* (1871) 147, pl. vi. 20 (genitalia); Rostock, Jahresb. d. Ver. f. Naturk. Zwickau, 1877, p. 89 (1878); Parfitt, Rep. & Trans. Devon. Association, xi. 398 (1879); Palmén, Paar. Ausf.-Gänge d. Geschl.-Org. b. Insect. S. 52 [anatom.] (1884).—‡ *H. flavipennis*, var. ?, Etn., *supra* at pp. 273 & 274 (1885).

Imago (*dried*).—Notum of ♂ pitch-brown; that of ♀ light yellowish brown approaching brown-ochre, varied on the metanotum with pitch-brown. Fore leg of ♂ somewhat rufo-piceous in opaque view, with an indistinct darker median band on the femur followed at a short interval by almost imperceptible traces of a preapical band; the extreme tips of the femur and tibia, and the tarsal joinings, piceous or blackish; 1st tarsal joint of normal length. Fore leg of ♀ raw umber-brown, with the median and preapical dark bands well defined; tibia lighter than the femur; tarsus partially or wholly concolorous with the femur. Hinder legs light yellowish brown, with browner femoral bands; both bands are well defined in ♀, but the proximal band is obsolete in ♂; tarsi more or less sepia- or warm sepia-brown, with dark incisures. Setæ greyish white, with piceous joinings; in ♀ some of the alternate joinings near the base of the setæ are narrower than the others. Wings vitreous: neuration in ♂ piceous, varying with change of posture from pitch-black to pitch-brown, the cross-veinlets in some lights

retaining the darker tint, while the longitudinal nervures assume the lighter; neuration in ♀ lighter than in ♂, especially towards the wing-roots, varying with change of posture from light pitch- or light bistre-brown to raw umber-brown, the cross-veinlets, as in the other sex, retaining the darker tint in some stand-points; in the ♂ the great cross vein of the fore wing is dark from the radius almost to its junction with the costa, but in the ♀ it is piceous only from the radius to about half across the marginal area, and is in its dark part more strongly contrasted in colour with the neighbouring nervures than in the ♂. In the pterostigmatic region of the fore wing of both sexes the reticulation formed by the branching and anastomosis of the cross-veinlets varies considerably in extent with the individual, but in comparison with that of some of the other species of this genus is unusually open in texture. ♂ (*living*).—Eyes black-brown. Notum atro-fuscous. Dorsum of abdomen light bistre-brown, with the tips of the segments darker; venter dark olive-grey, usually spotless. Setæ light greenish grey, with darker joinings. Legs somewhat as in dried specimens; the tarsi and fore tibia fuscous; the bands of the hinder femora light reddish or carneous. Wings vitreous, with blackish neuration, and with a slight discoloration in the pterostigmatic region of the fore wing. Length of body 12–15; wing, ♂ 13–14, ♀ 14; setæ ♂ im. 25–28 mm.

Hab. England; near Reading, on the Thames above Pangbourne, and on the Holybrook above Coley Park, towards the end of May. Holland, near Arnheim in Gelderland (2 ♂ and 2 ♀ im., captured by Mr. Meddenbach van Rooy, in Albarda Mus.) at the end of May and beginning of June. Mr. Albarda has taken objection to the blunder committed by me, at p. 274 *supra*, in referring this species (albeit with hesitation) as a variation to *Heptagenia flavipennis*, and has lately forwarded to me for inspection the four Dutch specimens mentioned above. My error arose from imperfect recollection of the insect, which I had not seen since the time of its original description.

Ecdyurus zebrata, Hagen.

‡ *Baëtis zebrata*, Hag., Ann. Soc. Ent. Fr. (1864) 38.

Heptagenia zebrata, Etn., Trans. Ent. Soc. London (1871) 155 [part.]; *vide* Hag. & Etn., *op. cit.* (1873) 406.

Subimago (*dried*).—Wings dark grey; longitudinal neuration yellowish; cross-veinlets edged with black.

Imago, ♂.—Eyes blue or green during life. Notum livid, clouded with brown. Abdomen yellow [jaune] with a broad median longitudinal black dorsal stripe, and oblique brown-black lateral stripes confluent with the bordering of the hind margins of the segments. Setæ white, annulated at the base, the middle, and the tip of each joint with black. Legs pale yellow, with the knee and tarsus brown, and a broad black median femoral band. Wings vitreous; the longitudinal nervures yellow; the cross-veinlets brown; hence the fore wing has a spotted appearance, especially along the anterior margin.

♀.—Similar, but larger than the ♂. The anterior margin of the fore wing is rather more spotted. Length of wing, ♂ 10, ♀ 12; setæ, ♂ im. 20, subim. 12, ♀ im. 15 mm.

Hab. Corsica (Hag.). [After Hagen.]

Ecdyurus fallax, Hagen.

‡ *Baëtis fallax*, ! Hag., Ann. Soc. Ent. Fr. (1861) 38.—‡ *B. sardoa*, ! Costa, Atti del. R. Accad. d. Sc. fisic. e matemat. di Napoli, ix. 34 (1882).

Heptagenia ‡ *zebrata*, ! Etn., Trans. Ent. Soc. London (1871) 155, pl. vi. 28 [detail (part.)], *vide* Hag. & Etn., *op. cit.* (1873) 406.

Imago (*dried*), ♂.—Notum raw umber-brown, varied posteriorly with darker. "Abdomen lighter than in *E. angustipennis*, brown ochreous, with the hinder borders of the dorsal segments black. Setæ dull yellowish, darker towards the roots." [After Hagen.] Fore leg in opaque view dark raw umber-brown, with the tarsus, in some postures, the tibia, the knee narrowly, and a darker broad band about the middle of the femur pitch-brown. Hinder femora and tibiæ *in opaque view* very light raw-umber, in other positions yellower, and *in transmitted light* yellowish amber-colour, with a similar pitch-brown or blackish band about the middle of the former, and with the knee slightly brownish; tarsi brownish, either dark raw umber or sepia, according to posture. Wings vitreous, with pitch-brown neuration; the cross-veinlets in some postures appear much darker than the longitudinal nervures, but in other postures the colouring is uniform, although the cross-veinlets are strongly marked: in the only specimen examined by me the pterostigmatic cross-veinlets of the fore wing are almost without exception branchless, and somewhat evenly distributed. Length of wing 8–9 mm.

Hab. Corsica (Hag.); Gennargento, Sardinia (Costa). The specimen labelled *E. sardoa* in Costa's handwriting, and kindly communicated to me by him, is a defective ♂ im., of which the abdomen is lacking. Judging from Hagen's description of *fallax*, there need be little doubt as to the identity in species of the insects to which the above names were applied: I have therefore relied largely upon Costa's specimen in this description.

Ecdyurus annulifer, Walker.

‡ *Palingenia annulifera*, ! Walk., Trans. Ent. Soc. London, N.S. v. 199 (1860).

Heptagenia annulifera, ! Etn., *op. cit.* (1871) 148.

Imago (*dried*), ♀.—Thorax somewhat brown-ochreous above, darker in the middle than at the sides of the pro- and mesonotum. Abdomen testaceous, with a stripe down the middle of the back, the hinder borders of the segments, and with the usual broad oblique lateral stripes at the sides, black. Setæ light-brownish white, with the alternate joinings black. "Legs whitish, the femur banded with black" (*teste* Walker). Wings vitreous with pellucid nervures, but with the cross-veinlets and the portions of the longitudinal nervures in close proximity to them pitch-brown and narrowly edged with the same colour. Length of body ♀ 6; wing 8; setæ 10 mm., or more.

Hab. Hindostan.

** *Penis-lobes obovate.*

Ecydurus affinis, sp. nov. Plate XXIV. 46*e* (penis).

Imago (*dried*), ♂.—Notum bright reddish brown or ferrugineo-piceous in part, sometimes approaching pitch-brown behind; the pleura are paler than in *E. lateralis*, and

hence the yellowish streak in front of the fore wing-roots is not conspicuous. Setæ whitish. Fore leg, in opaque view, piceous, excepting the tarsus and the basal half of the femur, which are lighter in colour. Wing-neuration in opaque view whitish, excepting, in the fore wing, the great cross vein and the roots of the subcosta and radius, which are slightly brownish in certain postures. (*Living.*)—Eyes intense burnt umber-brown above, black beneath, traversed by a chrome- or lemon-yellow line. Pronotum yellow-ochreous, with a piceous streak on each side; mesonotum bistre-brown; tegulæ yellowish ochre; metanotum either pitch- or jet-black; pleura rufo-piceous, with black streaks descending in front of the bases of the coxæ; sternum rufo-piceous. Abdomen either rufo-badious [a colour approaching Mars orange] or reddish umber-brown: the dorsal joinings and a short acute triangular streak from the base of each segment except the last two, coincident with the tract of the dorsal vessel, darker than the ground-colour; in segments 2–6 above the pleura on each side of the back is a large triangular or quadrilateral ochraceous spot tapering anteriorly, which contrasts to advantage with the contiguous portions of the dark joining; in segments 7 and 8 the corresponding pale spaces are much smaller and less distinct. Venter in some specimens pale lurid, with a continuous median series of obcordate blotches approaching Mars orange in colour. Setæ white, with the first three or four joinings rufescent. Fore femur either piceous or rufo-piceous in its distal half, and paler or lurid towards the base, with traces of a dark median band; tibia and all but the last joint (which is either rufo-piceous or darker than the other joints) of the tarsus either blackish grey or cervinous. Hinder legs lurid testaceous, with the median band and the tip of the femur, the base of the tibia, and the joinings and terminal joint of the tarsus rufescent piceous, and the spinule of the trochanter piceous or black; sometimes the tarsus is altogether reddish. Wings vitreous, neuration colourless. Length of body, ♂ 12–13·5, wing 10–11, setæ ♂ im. 15–16 mm.

Hab. The Netherlands. This species was first communicated to me by Mr. Albarda, who thought it might be identical with one of Hagen's Corsican species. I afterwards met with it near Arnheim; it is common in the neighbourhood of the railway-bridge at the end of July, and doubtless earlier before the seasonal rise of the Rhine.

Ecdyurus lateralis, Curtis.

‡ *Baëtis lateralis,* Curt., Lond. & Edinb. Philos. Mag. ser. 3 (1834) 121; ! Steph., Ill. Brit. Ent. vi. 65 (1835); Pict., Hist. Nat. Névropt. ii. Ephém. 175, pl. xxi. 2–6 (1843–5); Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 557 (1853); Hag, Ent. Ann. (1863) 28.—*B.* ‡ *obscura,* Pict., Hist. Nat. Névropt. ii. Ephém. 182, pl. xxiii. 1 (1843–5); Walk., List &c., part iii. 557 (1853); Hag., Ent. Ann. (1863) 28 [nec ! Steph. 1835].

‡ *Cloë brunnea,* Ramb., Hist. Nat. d. Ins. Névropt. 298 (1842); Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 557 [as var.? of *C.* ‡ *halterata*] (1853); Rosenhauer, Thier. Andalus. 366 (1856); Ed. Pict., Synop. Névropt. d'Espag. 26 (1865).

Heptagenia lateralis, ! Etn., Trans. Ent. Soc. London (1871) 155, pl. vi. 27 [detail]; Meyer-Dür, Bull. Soc. Ent. Suisse, iv. 313 (1874).—*H. obscura, id.,* loc. cit. (1874); Rostock, Jahresb. d. Ver. f. Naturk. Zwickau, 1877, p. 91 (1878).

Subimago (dried).—Wings uniformly tinted either with brownish [vandyke] grey, or

(in some of the ♂ Scotch examples) with blackish grey: the brown-grey tint matches with that of the wings of *Cloëon simile*, subimago, and the black-grey with that of the fore wings of *Ephemerella ignita*, subimago.

Imago (*dried*), ♂.—Notum dark pitch-brown. Setæ light bistre-brown, sometimes with the joinings opaque. Fore leg pitch-brown, lighter or bistre-brown towards the base of the femur. Hinder legs light bistre-brown, with the knee and the tarsus pitch-brown or blackish. (*Living.*)—Eyes very intense burnt umber-brown. Notum jet-black; a greenish-yellow or sulphur-coloured streak usually prolonged forwards from the fore wing-roots strongly contrasts in colour with the dark pleura. Dorsum of abdomen bistre-brown, modified with burnt-umber; segments 2–6 are lighter than the remainder, and have each of them the whole of the terminal margin narrowly bordered with pitch-brown or a darker colour, a fuscous spot posteriorly on both sides, which disappears in drying, and a pale space or cloud above the spiracular line on each side in the midst; the remaining segments likewise are paler near the same line. Venter sepia-brown, tinged in the anterior segments with greenish; the penultimate segment, tinged with orange near the insertions of the forceps-limbs, has on each side a piceous lanceolate wart resembling a spine. Forceps black, greyish inside distally. Setæ sepia-brown. Wings vitreous, with pitch-brown neuration. Fore femur fuscescent at the base, and pitch-brown towards the tip; tibia and tarsus pitch-black. Hinder legs subfuscous; the femur has a small subrufescent cloud nearly in the middle towards its upper edge, and the tarsus is black-grey.

♀.—Very similar to the ♂. (*Living.*)—Abdomen more uniformly opaque than in the other sex, and marked on each side, in most of the segments, either with a dark triangular spot or an oblique dark stripe from the terminal border. Venter fuscous, with greenish-grey joinings; the terminal ganglionic mass of the nervous tract is sometimes tinged faintly with warm sepia-brown. Length of body 5–9; wing, ♂ 6–10, ♀ 7–10; setæ, ♂ im. 19, subim. 10, ♀ im. 15, subim. 8 mm.

Hab. Locally common in the west and north of Great Britain, extending to Dorset in the south. It chiefly inhabits trout-streams and the shores of lakes in hilly and mountainous districts; and the fly appears from May to August. Nowhere have I found it more abundant than it was along the shore of Ullswater, in Westmoreland, under Kail-pot Crag, on 1st July. On the Continent it has an extensive range:—Styria (Brauer); Carinthia (Zeller in M'Lach. Mus.); Switzerland (Pictet and Meyer-Dür); Savoy, at the Lac de Montriond (3440 ft.); the stream below Freycinet-la-Tour (Haute-Loire) in the direction of Les Estables, in company with *Odontocerum* (3770 ft.); Spain (Rambur). Small specimens of *Rhithrogena semicolorata*, ♀ im., are liable to be mistaken for this species, should their femoral spots happen to be indistinct; but they are distinguishable from it by their having simple, instead of branched and anastomosing cross-veinlets in the pterostigmatic space of the fore wing, by the absence of the bright-yellowish streak in front of the fore wing-roots, and by the ventral lobe of the 9th abdominal segment being emarginate instead of seemingly subacute, or at least entire.

EPHEMERIDÆ OF UNCERTAIN GENERA.

The generic names here attributed to species placed in this category, when not of very recent origin, are used in a lax and unrestricted sense, such as was accorded to them by Pictet (1843–5) or by myself in the year 1871.

AMERICAN SPECIES OF UNCERTAIN GENERA.

Potamanthus Vogleri, Weyenbergh.

Cloë (?) *Vogleri*, Weyenbergh, Tijdschr. v. Ent. xxvi. 1882–3, p. 171, pl. x. 5 (1883) [wings].

Imago (*living*), ♂.—Thorax jet-black; abdomen black; setæ 3, greyish, with black joinings; legs somewhat pearl-grey, but darker. Wings vitreous, with black neuration, excepting that the fore wings from the costa to the radius are dark-tinted. [In the figure the proximal half of the marginal area is colourless.] Hind wing very small, traversed by a single longitudinal median nervure, which does not extend quite to the margin.

♀.—Abdomen of lighter colour than that of the male. Length of body 3·5, setæ 14–15 mm.

Hab. At Paseo Sobremonte, Cordova, Argentine Republic, flying in the sunshine at about 8 A.M., on the 20th of April.

From the figure of the fore wing and items detailed in the original description, it is evident that this species represents a genus of the Fifth Section, or *Leptophlebia*-type. What is stated of the hind wing should, perhaps, be received with caution, because, from inspection of the figures, it appears that Prof. Weyenbergh was not accustomed to flatten out the wings he delineated.

Potamanthus Siewerthi, Weyenbergh.

Cloë Siewertii, Weyenbergh, Tijdschr. Ent. xxvi. 1882–3, p. 170 (1883).

Imago (*living*).—Upper portion of oculi dark red; thorax sepia-brown; abdomen dark grey, darker at the joinings; setæ 3, pearl-grey, with darker joinings. Femora [sprieten] blackish; the remainder of the legs [pooten] light grey. Wings dull, spotless. Hind wings very small. Length of body 3, setæ 9 mm.

Hab. Cordova, Argentine Republic; sparingly in November.

Potamanthus (?) inanis, Pictet.

Potamanthus?‖ *inanis*, Pict., Hist. Nat. Névropt. ii. Ephém. 232, pl. xxiv. 4 (1842–5); Walk., List of Neuropt. Ins. in Brit. Mus. 517 (1853); Etn., Trans. Ent. Soc. London (1871) 91 [nec *E. inanis*, Gmel. 1790].

Imago (*dried*), ♂.—Thorax polished bright brown. Abdomen whitish for the most part, but with the tip brown, and with a large brown dot on each side of every whitish segment. Setæ greyish, dotted with black. Legs brown. Wings vitreous, slightly greyish, rather darker along the costa, and tinged faintly with yellowish at the base;

neuration brown; cross-veinlets sparse. Hind wings seemingly absent. Length of body 5, wing 6, setæ 6 mm.

Hab. Brazil (Vienna Mus.). [After Pictet.] Pictet did not know exactly to which of his genera this species should rightly be referred. His figure attributes to the mesothoracic wings a shape which would lead one to suspect that the absence of hind wings in his two specimens was due to *Psocidæ* or other cabinet pests. Otherwise, his statement that cross-veinlets exist only in the anterior portion of the mesothoracic wing would render it probable that the species might be related in some degree to one of the genera illustrated in Plate XV. of the present volume,—supposing him to have used a lens of low power in his examination of the specimens, and their setæ to have exceeded his estimate in length.

THRAULUS (?) VITRIPENNIS, Blanchard.

Ephemera (*Cloë*) *vitripennis*, Blanch., Gay, Hist. fisic. y politic. de Chile, vi. 107, Atl. Névropt. ii. 3 (1851).

Cloëon vitripenne, Etn., Trans. Ent. Soc. London (1871) 107.

Imago.—Body of a light brownish olive; head flavo-rufous above. Mesothoracic wings vitreous. Legs light testaceous; femora banded with fuscous in the middle and at the tips. Setæ whitish, annulated with brown. Hind wings absent.

Hab. Chili. [After Blanchard.] Probably a *Thraulus*, of which the hind wings had been destroyed by *Psocidæ*.

SIPHLURUS QUEBECENSIS, Provancher.

‡ *Baëtis* ‡ *canadensis*, Provancher, Natural. Canad. viii. 267 (1876); id. Fn. Ent. d. Canad. ii. fasc. i. 83 (1877).

Siphlurus quebecensis, Hag. MS., *op. cit.* ii. fasc. i. [corrections] 82* (1877).

Brune; le vertex et le disque du prothorax ferrugineux. Abdomen avec la base des segments testacée, surtout sur les côtés. Pattes pâles, cuisses brunes, jointures des articles des tarses noires. Ailes hyalines, le bord costale brun à l'extrémité et quelque peu ferrugineux à la base; nervures transversales brunes. Soies très longues, pâles, à jointures brunes. ♂ Sous-parfait: ailes un peu obscures, couleur du corps plus sombre. Long. ·40 pouce; soies 1·20. [After Provancher.]

HEPTAGENIA QUEBECENSIS, Provancher.

‡ *Cloë quebecensis*, Provancher, Natural. Canad. viii. 267 (1876); *id.*, Fn. Ent. d. Canad. ii. fasc. i. 84 (1877).

Heptagenia quebecensis, Hag. MS., *op. cit.* ii. fasc. i. [corrections] 82* (1877).

Brun varié de roussâtre. Thorax poli, d'un brun roussâtre, les côtés avec les sutures jaunâtres. Ailes. . . . parfaitement hyalines, les nervures transversales interrompues, peu apparentes. Pattes brun pâle, les jointures des articles des tarses antérieurs noires. Abdomen brun, blanchâtre sous le ventre et à la base des segments sur les côtés. Soies caudales. . . . blanchâtres, à jointures brunes. Long. ·40 pouce, soies ·65.

Hab. Quebec, common. [After Provancher.]

HEPTAGENIA ‡ PUDICA, Hagen.

Heptagenia ‡ pudica [♀ subim.], ! Hag., Ann. Rep. U.S. Geol. & Geograph. Survey of the Terr. 1873, part iii. Zool. 581 (1875); [nec ‡ *Ephemera pudica*, ! Hag. (1861) = *Ecdyurus vicarius*].

Subimago (*dried*), ♀.—The two specimens supposed in 1875 to be identical with the species described in 1861 as *E. pudica* differ from this last specimen, but agree with each other in the following particulars:—In the tarsus, joint 1 is the longest, joints 2–4 diminish successively in length, and joint 5 is as long as (if not longer than) joint 1; ungues unlike each other in form. Wings talcose, grey-tinted in the disk, and slightly yellowish along the costa; longitudinal neuration at first flavescent, and banded with greyish black, but becoming in a large extent darker before the moult; cross-veinlets pitch-black, mostly bordered faintly with grey, this colour also spreading along the longitudinal nervures in the vicinage of their junctions with the former: near the anal angle of the fore wing many of the cross-veinlets are at first pale and unbordered, but after a time they become dark like the others. The wing-neuration is comparable to that represented in Pl. XXIII. fig. 41, the cross-veinlets being rather evenly distributed in the disk; the marginal area of the fore wing contains 9–11 cross-veinlets before the bulla, 1 or 2 at the bulla, and about 20 rarely forked beyond it. Notum lutescent. Abdomen striped obliquely at the sides with black, and marked at the bases of most of the ventral segments with two fine divergent black lines. The ventral lobe of segment 9 appears to be obtuse behind, with a slight sinus in the middle closely flanked on either side by a small acute tooth. The specimens were ticketed 82 and 83; and the left hind leg of 82 was atrophied. Length of wing 20 mm.

Hab. Foot-hills, Colorado (W. L. Carpenter) in August. (Mus. Comp. Zool. Cambridge, Mass.) This species may be related generically to *Epeorus*.

HEPTAGENIA BASALIS, Walker.

‡ *Baëtis basalis*, ! Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 565 (1853); Hag., Smithson. Miscell. Coll. (1861) Synop. Neuropt. N. Am. 50; [nec *B. basalis*, Steph., Cat.].

Heptagenia basalis, ! Etn., Trans. Ent. Soc. London (1871) 139, pl. vi. 15, 15 *a* [detail].

Imago (*dried*), ♂.—Notum piceous. Abdomen pitch-brown, pale at the joinings. Setæ very light reddish [Roman] sepia-grey, with pitch-brown joinings. Legs absent. Wings vitreous, with pitch-black neuration: the fore wing towards the inner margin, and the hind wing at the base, tinged with dark vandyke-grey; the cross-veinlets in the disk of the fore wing near the base of the wing, and between the costa and the pobrachial (7) nervure, are narrowly edged with pitch-brown, or, in parts, with pitch-black; their edging in two places coalesces into pitch-black spots, situated one at the bulla of the subcosta, and the other about midway between that and the extremity of the marginal area. Length of body 13, wing 14, setæ 25 mm.

Hab. Lake Winnipeg (Brit. Mus.).

HEPTAGENIA PULCHELLA, Walsh.

‡ *Palingenia pulchella*, Walsh, Proc. Acad. Nat. Sc. Philad. (1862) 375; Hag., Proc. Ent. Soc. Philad. ii. 177 (1863); Walsh, *op. cit.* ii. 203 (1863).

Heptagenia pulchella, Walsh, *op. cit.* ii. 204 (1863); Etn., Trans. Ent. Soc. London (1871) 141.

Subimago.—Wings subopaque, clouded with fuscous; cross-veinlets fuscous, bordered with fuscous; hind wings paler than the fore wings, and tipped with fuscous.

Imago (*living*), ♂.—Fore tarsus $1\frac{1}{4}$ to $1\frac{1}{2}$ as long as the tibia; joints 1–3 of the tarsus subequal to each other. Eyes pearly whitish, changing to blackish. Notum ferrugineo-piceous, with the meso- and metathoracic scutella whitish. Abdomen, in segments 2–7, and the base of segment 8, whitish hyaline, with the extreme terminal edges of the segments dark, and usually with a large fuscous dot at each of the spiracles; the remainder of the dorsum ferrugineo-piceous. Venter whitish. Setæ whitish, with fuscous joinings alternately narrow and broad in the basal half. Fore leg pale yellowish; the femur with a median and a terminal band, the tip of the tibia, and the joinings and tip of the tarsus fuscous: hinder legs whitish, marked palely in correspondence, wanting sometimes the median femoral band. Wings hyaline, clouded with pale brown in the pterostigmatic space of the fore wing: neuration for the most part fuscous, but the "costal veins" [? subcosta and radius] in their basal $\frac{2}{3}$ are yellowish, and in the hind wing the "post-costal veins" [? those posterior to the pobrachial (7)] and cross-veinlets are hyaline.

♀.—Vertex whitish, varied with luteous or ferrugineous; notum whitish, varied with luteous; sternum and pleura whitish. Dorsum and venter egg-yellow when full of eggs; the dorsum marked in joints 1–6 as in ♂, and slightly tinged sometimes in segments 7–9 with ferrugineous. The pterostigmatic cloud is lighter than in ♂; and the neuration of the hind wing is mostly hyaline. Length of body 5–8; setæ, ♂ im. 17–21, subim. 10–13, ♀ im. 15–16, subim. 8–13 mm.

Hab. Rock Island, Ill., and Maryland. In the fore wing the great cross-vein is very strong, and the cross-veinlets, especially in the front of the wing, are coarser than the longitudinal neuration. [After Walsh.]

HEPTAGENIA TERMINATA, Walsh.

‡ *Palingenia terminata*, Walsh, Proc. Acad. Nat. Sc. Philad. (1862) 376; Hag., Proc. Ent. Soc. Philad. ii. 177 (1863); Walsh, *op. cit.* p. 203 (1863).

Heptagenia terminata [sp. ? or *H. pulchella*, var. ?], Etn., Trans. Ent. Soc. London (1871) 141 note [after Hag.].

‡ *Bætis* ‡ *interpunctata*, Provancher, Natural. Canad. viii. 266 (1876); *id.*, Fn. Ent. d. Canad. ii. fasc. i. 83 (1877) [corrected at *op. cit.* p. 82² (Hag. MS.)].

Perhaps only a variation of *H. pulchella*. The ♂ *imago* has segments 2–7 of the abdomen pale yellowish, without dots at the spiracles; the hinder legs pale yellowish, usually wanting the median femoral band. In the fore wing the cross-veinlets are scarcely coarser than the longitudinal nervures (whence the wing seems paler than in *H. pulchella*) and the "second costal vein" [? subcosta or ? radius] is generally thickened and clouded for the length of 0·5 mm. at the bulla, which is rarely so in *H. pulchella*.

Length of body 6·5–8·5; setæ, ♂ im. 19–22, subim. 12–13, ♀ im. 18–22, subim. 15–18 mm.

Hab. Rock Island, Ill. [After Walsh.]

HEPTAGENIA SIMPLEX, Walsh.

Heptagenia simplex, Walsh, Proc. Ent. Soc. Philad. ii. 204 (1863); Etn., Trans. Ent. Soc. London (1871) 141.

Subimago.—Wings and neuration yellowish.

Imago (*living*), ♂.—Fore tarsus $\frac{3}{4}$ as long as the tibia: joints 1–3 of the tarsus subequal to each other; joint 4 a little shorter. Eyes bright greenish yellow. Notum flesh-colour. Abdomen in segments 2–7 hyaline; segments 8–10 whitish; forceps white; setæ white, tinged with dusky at the extreme tip. Femora yellow or yellowish; tibiæ and tarsi white, with the extremities of the tarsi, the tip of the fore tibia, and sometimes the joinings of the fore tarsus fuscous. Wings hyaline; neuration colourless, excepting in the distal $\frac{1}{2}$ or $\frac{2}{3}$ of the fore wing, where it is fuscous, and sometimes the cross-veinlets of the marginal area of the same wing are also fuscous; in the pterostigmatic region the cross-veinlets are coarse.

♀.—Fore tarsus $\frac{1}{2}$ as long as the tibia; joint 1 as long as joint 2. Abdomen egg-yellow. Setæ scarcely tinged with dusky at the tip. Only the extremities of the tarsi are a little tinged with fuscous. Wing-neuration colourless, excepting that a few cross-veinlets towards the extremity of the costa are dusky, and that the costa, subcosta, cubitus, and radius are tinged with yellowish. Length of body, ♂ 6–8, ♀ 7–8·5; setæ, ♂ im. 14–18·5, subim. 10·5, ♀ im. 14–16, subim. 10–15; expanse of wings, ♂ 16–20·5, ♀ 19–25·5 mm.

Hab. Rock Island, Ill., June. [After Walsh.]

HEPTAGENIA CRUENTATA, Walsh.

Heptagenia cruentata, Walsh, Proc. Ent. Soc. Philad. ii. 205 (1863); Etn., Trans. Ent. Soc. London (1871) 140.

Subimago.—Wings and their neuration dull opaque yellowish. Setæ tinged with dusky; their joinings fuscous, less distinct than in the imago.

Imago (*living*), ♂.—Yellowish. Fore tarsus as long as the tibia; the first joint much shorter than the second. In the hinder tarsi joint 1 is slightly shorter than joint 2. Eyes pale bluish grey, intersected by a black line. Notum and dorsum sanguineous. Setæ whitish, with fuscous joinings, which towards the base are alternately broad and narrow. Forceps pale, fuscous towards the tips. In every leg the distal half of the femur, the basal $\frac{1}{3}$ and the terminal $\frac{1}{3}$ of the tibia are pale sanguineous, that portion of the femur presenting at each extremity a narrow dark sanguineous annulus, and the tarsus has dusky joinings and ungues. Wings hyaline, tinged uniformly with yellowish along the costa; neuration close to the wing-roots hyaline, but elsewhere fuscous, excepting the costa, which is tinged with yellow in its basal $\frac{2}{3}$: the bulla of the "2nd costal vein" [? subcosta] for about 0·5 mm. is thickened and obfuscated.

♀.—Fore tarsus shorter than the tibia; joint 1 shorter than joint 2, and slightly so in

the hinder tarsi. Occasionally paler than ♂, and sometimes with the venter sanguineous. The hyaline portion of the wing-nervures is more extensive than in ♂, especially in the hind wings. Length of body 7–9; setæ, ♂ im. 25–27, subim. 12–14, ♀ im. 17–20 mm.

Hab. Rock Island, Ill. [After Walsh.]

HEPTAGENIA MACULIPENNIS, Walsh.

Heptagenia maculipennis, Walsh, Proc. Ent. Soc. Philad. ii. 206 (1863); ! Etn., Trans. Ent. Soc. London (1871) 139.

Subimago.—Wings tinged with dusky; cross-veinlets slightly bordered with dusky. Setæ tinged with dusky towards the tips.

Imago, ♂.—Fore tarsus longer than the tibia, with the first joint about $\frac{1}{3}$ as long as the second; in the hinder tarsi the first joint is as long as the second. The peculiarity of the cross-veinlets of the fore wing, described below, is noteworthy. Notum ferrugineous. Dorsum of abdomen pale yellowish to the basal $\frac{1}{3}$ of segment 7, and then piceous up to the extreme base of segment 10; the remainder pale yellowish. Setæ and forceps whitish. Femora yellowish, usually with a short fine fuscous vitta beneath at the tip; tibiæ and tarsi whitish, the tip of the fore tibia and the ungues fuscous. Wings hyaline: in the fore wing most of the longitudinal nervures are fine and dusky, and most of the cross-veinlets black; but the neuration of the axillar region, like that of the whole of the hind wing, is colourless: in the fore wing the black cross-veinlets are comparatively coarse, and some of them are bordered with coal-black, several of those in the marginal and submarginal areas being immersed in small rounded blots of that colour. The cross-veinlets of the marginal area are unevenly spaced; 3 stand close together in a group at the bulla apart from the others in that area; and again, in the pterostigmatic portion of the same, midway between the bulla and the apex, is another similar group of 4 or 5 cross-veinlets, bordered with black like those of the former group: in all, the area contains, from the great cross-vein up to the bulla, 4–6 heavily bordered cross-veinlets, and beyond the bulla about 13, of which last only the 4 or 5 above mentioned are bordered. In the next two areas, 2–3 cross-veinlets are likewise grouped together in rear of the bulla apart from the others of those areas.

♀.—Paler than the male; dorsal segments 8–10 opaque whitish, tinged more or less with ferrugineous. The bordering of the cross-veinlets is rather lighter than in ♂. Fore tarsus longer than the tibia; joint 1 about $\frac{2}{3}$ as long as joint 2. Length of body 4·5–6; setæ, ♂ im. 12–15, subim. 7·5, ♀ im. 9–12, subim. 8 mm.

Hab. Rock Island, Ill. (Walsh); United States (M'Lach. Mus.). [Chiefly after Walsh.]

ECDYURUS GUTTATUS, Pictet.

‡ *Bætis guttata*, Pict., Hist. Nat. Névropt. ii. Ephém. 187, pl. xxiv. 3 (1843–45); Walk., List of Neuropt. in Brit. Mus. part iii. 559 (1853).

Ephemera (*Baëtis*) *guttata*, Blanchard, Gay, Hist. fisic. y politic. de Chile, vi. 106, Atl. Névropt. ii. 2 (1851).

Heptagenia guttata, Etn., Trans. Ent. Soc. London (1871) 156.

Imago (*dried*), ♀.—Head and thorax fuscous, varied with small spots of yellow and

brown. Abdomen yellow [fuscous in the figure cited], with the apical borders and oblique lateral stripes of the segments black, and with two longitudinal dorsal and ventral series of black dashes or streaks besides. Setæ yellow, with black annulations that are narrow and broad alternately. Legs ochreous; a spot on the femur and the extremities of both femur and tibia piceous. Wings vitreous, with black neuration, and with a brownish tint in the costal region, where the cross-veinlets are coarser than elsewhere, and irregular. Length of body, ♀ 12; wing about 14; setæ 18 mm.

Hab. Valdivia, Chili (Blanchard).

EUROPEAN SPECIES OF UNCERTAIN GENUS.

Baëtis fuscus, Schneider.

Cloë fusca, Selm., Stett. ent. Zeit. vi. 340 (1845).
Baëtis? fuscus, Etn., Trans. Ent. Soc. London (1871) 120.

Imago ♀.—"Tergum thoracis fuscum; alæ vitrinæ, nervis fuscis, antica area costali apicem versus fulvescente, et nervis transversalibus pluribus. Pedes saturate testacei. Abdomen supra rufescens, apicibus segmentorum brunneis; subtus testaceum. Setæ saturate testaceæ, fusco annulatæ." Long corp. ♀ 2·75, set. 6·25 lin.

Hab. Messina, April. [After Schneider.]

Heptagenia iridana, Kolenati.

Baëtis iridana, Kolen., Wien. ent. Monatschr. iv. 383.
Heptagenia iridana, Etn., Trans. Ent. Soc. London (1871) 148.

Imago.—"Corpore rufo-brunneo, segmentis abdominis dorsalibus postice late brunneo marginatis; alis iridinis, tribus nervorum anteriorum flavis, reliquis brunneis, pterostigmate [*i. e.*, apice areæ marginalis] infumato vel flavescenti. Venter luteo-brunneus, setis obscurior." (Kolen.) Long. corp. 3·5; al. 5; set. 12 lin.

Hab. Altvater, in August and September, at an altitude of 4000 feet. The type is in the Royal Polytechnic, Brunn.

Baëtis vitreatus, Zetterstedt.

Ephemera vitrea, Zett., Ins. Lap. col. 1045 (1840).
Baëtis vitreatus, Wallengren.

"Nigra, nitida, pedibus sordide luteis, alis hyalinis, nervis valde tenuibus albidis crebre reticulatis, setis caudalibus pallidis, articulatione fusca. Mas: abdominis medio foreipeque sordide alba. Fem.: abdomine toto nigro." Long. corp. fere 4; al. exp. 8 lin.

Hab. Western Finmark by standing water near Bozzekop, August 7th. Setæ 2, dirty white, with fuscous joinings. (Zetterstedt.)

Heptagenia montana, Pictet.

‡ *Baëtis montana*, Piet., Hist. Nat. Névropt. ii. Ephém. 172, pl. xx. 3 (1843–45); Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 557 (1853); Brauer, Neuropt. Austr. 26 (1857); Ausser., Ann. d. Soc. Natur. Modena, Ann. iv 434 (1869).

Heptagenia montana, Etn., Trans. Ent. Soc. London (1871) 154; Meyer-Dür, Bull. Soc. Ent. Suisse, v. 313 (1874).

Imago (*living*), ♂.—Head black; eyes blue. Pronotum reddish, with a median black spot; meso- and metanotum black, the sides of the thorax lighter. Abdomen greyish brown [in the figure light yellowish olive, with the joinings of the segments and oblique stripes at the sides dark]. Setæ fuscous. Fore legs black; hinder legs fulvous. Wings vitreous, with a slight brownish tint in the pterostigmatic region of the fore wing; neuration fine and black. Length of body 13, wing 13, setæ 30 mm.

Hab. Alpine Savoy, *e.g.* at a small stream descending from the Brevent above Chamounix. [After Pictet.]

Heptagenia gemmata, Scopoli.

Ephemera gemmata, Scop., Ent. Carn. 264, pl. xxxviii. 683 [wretched fig.] (1763); Müll., Zool. Dan. Prodr. 143 (1776); Vill., C. Linn. Ent. iii. 22 (1789); Ol., Encycl. Méth. vi. 421 (1791); Etn., Trans. Ent. Soc. London (1871) 156 note; Hag., *op. cit.* (1873) 406.

Imago (*dried*), ♀.—Corpus rufum. Incisuræ abdominis marginibus flavicantibus. Long. 17 mm.

Hab. Circa aquæductum Fodinarum Idrensium. [After Scopoli.] According to Dr. Hagen (1873) this species is related to *Ecdyurus venosus*.

Species, some of which have been published elsewhere during the progress of this work, and others now first published.

The following species ought to follow *Campsurus dorsalis*, p. 42:—

Campsurus Wappei, Weyenbergh.

‡ *Ephemera Wappæi*, Weyenb., Tijdsch. v. Ent. xxvi. 1882–3, p. 159, pl. x. 1 (1883) [wings].

Adult.—Head light yellowish brown; eyes small, black. Pronotum somewhat darker than the head; mesonotum (*during life*) yellow, changing (*when dried*) to yellow-brown; metanotum often somewhat darker. Abdomen above greyish yellow, becoming gradually darker and sometimes approaching black posteriorly; venter yellowish grey throughout; the two appendices very pale, the "palpen" darker. Legs yellow or greyish yellow. Wings transparent, but rather dull; fore wings along the costal border brownish grey through the colouring of the subcosta and radius.

In the ♀ the abdomen posteriorly is rather darker above than it is in the ♂. Length of body 13 or under, wing 18, setæ ♂ 40–43 mm.

Hab. Cordova, Argentine Republic. [After Weyenbergh; condensed translation.]

Campsurus Holmbergii, Weyenbergh.

‡ *Ephemera Holmbergii*, Weyenb., Tijdsch. v. Ent. xxvi. 1882–3, p. 160 (1883).

Adult.—Vertex of head very dark between the black eyes. Thorax and abdomen very largely overspread above by dark grey markings approaching sepia-brown, the remaining

surface being of a dirty yellow colour. The dark markings comprise, on the thorax,—an almost circular stripe on the neck; two very large subquadrate spots and the commencement of a longitudinal median line on the pronotum; two longitudinal stripes on the mesonotum united by a transverse band before the metanotum; and two somewhat confluent and more or less raised [knobbelachtig] black spots upon the hind border of the metanotum preceded by four similar black dots somewhat coalescing into a more or less curved line:—the markings on the abdomen comprise,—two small oblong spots on the dorsum of the first segment situated one on each side of the middle line and somewhat near the lateral border; in the next segment the corresponding marks are widened, and in the fourth and fifth segments the spots begin to be blended into one; in the following segments the corresponding spots become gradually larger, so that towards the extremity of the body the whole of the dorsum is occupied by the grey-black colour, excepting the lateral borders of the segments and the whole of the terminal segment, which remain of a yellowish colour. Venter uniformly pale yellow. On each side of the mesothorax a fine oblique dark line extends backwards and downwards from the transverse band of colouring mentioned above, and sometimes unites with a very similar line running downwards in the opposite direction upon the side of the metathorax so as to form a single arcuate line. Setæ shorter than in *C. Wappæi*. Length of body 12 mm.

Hab. Buenos Ayres; scarce. [After Weyenbergh; abstract of translation.]

Campsurus Nappii, Weyenbergh.

Palingenia Nappii, Weyenb., Tijdsch. v. Ent. xxvi. 1882-3, p. 162, pl. x. 2 (1883) [wings].

Adult.—Eyes brown-black. Underside of body yellowish. Pronotum greyish yellow, with a darker longitudinal double median stripe, and with an extremely narrow, dark, nearly brown edging to its hind margin; the remainder of the notum grey-brown, with three darker longitudinal stripes; the sides of the thorax lighter. Abdomen anteriorly greyish above, with a darker transverse band in the hinder part of every segment; posteriorly these bands become successively broader, until in the seventh to the ninth segments almost the whole surface of the dorsum is occupied by the darker colour; the tenth segment, however, remains yellow. Setæ transparent white. Legs [pooten en sprieten] greyish, in some degree tinged with brownish. Wings transparent; fore wing darker along the costal margin, owing to the colouring of the subcosta and radius, and sometimes slightly lactescent in the remainder of the disk, as is usual in subimagines. Length of body 13, wing about 12, setæ ♂ about 33 millim.

Hab. Santiago d. E., Argentine Republic; January. [After Weyenbergh; abstract translation.] Judging from the figures of the wings, I am disposed to rank this species in *Campsurus*, as well as the two preceding, pending further observations. The wings illustrated by Prof. Weyenbergh in the cited publication appear to have been drawn *in situ*, without being flattened out; and this should be borne in mind when reference is made to the plate.

These Species should follow Ephemerella ignita, p. 127.

EPHEMERELLA NOTATA, sp. nov. Plate LXV. 9 (genitalia).

Subimago (*living*).—Wings whitish grey, paler in proximity to the roots in some lights; neuration in a large measure concolorous with the membrane or whitish, but in the fore wing the great cross-vein, the greater portion of the subcosta and radius, and in certain lights the remaining longitudinal nervures, are light greenish yellow approaching yellow-lake. Setæ dark vandyke- or reddish-grey with reddish joinings. Hinder legs light olive-grey with greyer tarsi: fore leg of ♂ rather darker.

Imago, ♂ (*living*).—Upper division of eyes light yellowish red (the "yellowish" approaching Mars-yellow, the "red" medium burnt-sienna); lower division brownish olive with a movable dark spot. Pronotum bistre-brown; meso- and metanotum raw-umber-brown; pleura much lighter in colour. Abdomen above translucent bistre-grey in segments 1–7, with the joinings more or less opaque; segments 8 and 9 raw-umber-brown; segment 10 much lighter than these: venter in segments 1–7 light greenish or ashy grey, marked with black lines and dots as in ♀ (see below); segments 8–10 somewhat brown-ochreous, paler along the middle and in segment 9 at the tip; forceps light greenish grey. Setæ light warm-sepia grey with reddish joinings. Fore legs dark bistre-grey; hinder legs rather greener or yellower, and lighter, with the tarsal joinings grey, and brownish ungues. Wings vitreous, with an evanescent yellowish stain in the pterostigmatic region; longitudinal neuration dull greenish grey; cross-veinlets more distinct than in *E. ignita*, and those in the pterostigmatic region less regularly forked or connected together than the corresponding veinlets of that species.

♀ (*living*).—Eyes light olive-green, with a movable round black spot; vertex of head light yellow; orbits of eyes and of the ocelli black, but the interspace between these last, and two unequal dots on each side of the frontal carina, light brown-ochreous. Pronotum lighter than the mesonotum, and traversed in rear of the outer ocelli by two longitudinal black stripes that are slightly divergent and dilated posteriorly. Meso- and metanotum light brownish-ochre, approaching Mars-yellow; the mesopleura in advance of the wing-roots light yellow. Abdomen in segments 1–7 yellower than in ♂, the prevailing tint approaching dull yellow-ochre; the remaining segments rather browner ochre than these; venter rather lighter than the dorsum: the abdominal markings comprise a fine, slightly irregular, transverse brownish line, close to the dorsal joining, at the base of the segment in segments 2–8 or 9, and some blackish marks in segments 1–8, viz.:—in segment 1 a streak at the side ascending the dorsal joining, a small spot above and an isolated longitudinal line below the pleural projection, and a dot nearly in the middle on each side of the ganglionic tract; in segments 2–7 a short isolated longitudinal linear streak met by a shorter erect or ascending streak and followed in certain instances by a small dot at the scar of the nymphal tracheal branchia, above the pleuron on each side, and a longer isolated linear longitudinal streak immediately below the pleuron; also in the same segments a pair of slender clavate streaks, half as long as the segment, divergent posteriorly, produced from the base of each segment; and

lastly, a pair of dots placed one on each side of the ganglionic tract nearly in the middle of each of these segments: in segment 8 the corresponding markings are ill defined. The pleura of segments 8 and 9 are acute behind. Femora yellowish instead of greenish, their colour approaching dull yellowish ochre. Eggs light yellowish. Length of body 8–9; wing 9–11; setæ, ♂ im. 15 & 14, subim. 7, ♀ im. 12 & 12·5, subim. 7 mm.

Hab. N. of England and S. of Scotland. Locally common by shallow and swift parts of the river Eden in Cumberland during June, near the villages of Langwathby and Salkeld. Its occurrence in Scotland is vouched for by a single subimago in Mr. King's collection. The ♂ imago, while in the net, can be distinguished from *E. ignita* by the yellowish tint of the pterostigmatic portion of the fore wing.

Ephemerella hispanica, sp. nov.

Subimago (*dried*), ♀.—Wings light blackish grey, with opaque neuration. Abdomen discoloured, but opaque: the terminal margins of dorsal segments 3–8 or 9 black in the middle for some distance transversely, and then pale towards the sides; the dorsum is flanked on each side by a single series of longitudinal black stripes placed at the bases of the pale pleura; these stripes are visible ventrally, and together with a median longitudinal black line, cause the venter (the joinings of which are pale) to appear trilineate. Setæ dark grey, with black joinings. Sutures of the mesonotum black; on each side of this segment, a little above the spiracle and in front of the tegulæ, is a small rounded black spot. Femur olive-grey; hinder tibiæ, in some lights, browner than the femora; tarsi and fore tibiæ in opaque view blackish.

Imago (*dried*), ♂.—Notum bright raw-umber-brown: the rounded black spots in front of the tegulæ are each subjacent to a black longitudinal line along the margin of the mesonotum: the thoracic pleura are raw-umber varied with dull light ochre, and their sutures in the neighbourhood of the hinder coxæ are black or pitch-black. Femora in opaque view light yellowish umber or corneous, becoming translucent in transmitted light; fore tibia dark pitch-brown, excepting just at the knee, which is concolorous with the femur; fore tarsus bistre-grey; hinder tibiæ almost concolorous with the femora, each with a blackish-grey stain externally just below the knee; hinder tarsi bistre-brown. Wings vitreous; neuration in some postures colourless, but in other postures the edge of the fore costa in its basal half appears blackish, and some of the stronger of the longitudinal nervures assume an olive-grey or brownish-amber tint, the bulla of the subcosta and the great cross-vein of the fore wing remaining colourless. Length of wing, ♂ im. and ♀ subim. 9 mm.

Hab. Spain; San Ildefonso, Segovia; captured in July by Messrs. Ed. Pictet and Meyer-Dür in the year 1859 (2 examples). By the courtesy of Mr. H. Albarda and Prof. E. Frey-Gessner, I have lately examined all that remains of the Spanish *Ephemeridæ* collected by the deceased Swiss entomologists above mentioned. A single ♀ subimago of this species is in Mr. Albarda's collection, and part of a ♂ imago in Ed. Pictet's Mus.; but the ravages of *Anthrenus* preclude full description of the insect from these materials.

From the same locality, in the same collection as the above species, are specimens of

Ephemerella ignita, and a fragmentary subimago of perhaps an undescribed species of this genus, all captured by the same entomologists in July 1859.

This should follow Ameletus exquisitus, p. 213.

Ameletus inopinatus, sp. nov. Plate LXV. 13 (genitalia).

Imago (*dried*), ♀.—Head and body pitch-brown, inclining to burnt-umber or rufo-piceous in the hinder abdominal segments; venter nearly concolorous with the dorsum. Legs *in opaque view* light pitch-brown; *in transmitted light* rich brown-amber or translucent raw-umber-brown. Wings vitreous, brilliantly iridescent, tinted uniformly and very faintly indeed with rusty brown or ferruginous; neuration *in opaque view* ferruginous or rufo-piceous, *in transmitted light* ferruginous-amber; cross-veinlets *in opaque view* delicate, except in the pterostigmatic region of the fore wing, and there many or some of those in the marginal area divide and anastomose so as to form an irregular and rather open reticulation. Counted at the subcosta the number of cross-veinlets in the marginal area of the fore wing is 13 before the bulla, and 27–29 beyond it. Length of wing 10 mm.

Hab. Europe: the Schwarzwald and Vosges. Described from a single ♀ specimen, of which the setæ were lost, captured by M'Lachlan at the end of July 1885 at the Feldbergsee (4000–5000 ft.), and a single ♂ im. taken by him in 1883 at the Lac de Retourna, both in M'Lach. Mus. The ♂ setæ are light brown with opaque joinings.

The Geographical Distribution of the Genera of Recent Ephemeridæ.

A brief summary of the geographical range of the genera and the number of known species by which they are represented may here be given advantageously.

Palingenia: Subgenus (typical). Eastern N. Temperate region, in large rivers, 2 sp.—Subgenus *Anagenesia*: Indo-Malay region and Irkutzk, 6 sp.—Subgenus ——, Brazil, 1 sp.

Oligoneuria: Europe, middle and south, with Egypt, 1 sp.; Brazil, 1 sp.

Elassoneuria: Natal, 1 sp.

Spaniophlebia: tropical S. America, 2 sp.

Lachlania: Central America and Cuba, 2 sp.

Homœoneuria: Central America, 1 sp.

Euthyplocia: Tropical America, 2 sp.

Campsurus: America, from Texas to Brazil, 8 sp.

Jolia: Europe, S. of France; N. America, Niagara 2; (?) sp.

Polymitarcys: Middle Europe to N. Africa, 2 sp.; Indo-Malay region, 1 sp.; N. America, 1 or (?) 2 sp.

Hexagenia: America N. and S., 6 sp.; E. Siberia, 1 sp. (undescribed); Hindostan, 1 sp. (undescribed).

Ephemera: Northern temperate regions, 10 sp.; Hindostan, Ceylon, 3 sp.; China, 1 sp.; Japan, 2 sp.; New Zealand, 1 sp. (undescribed).

Pentagenia: Illinois and Texas, 2 sp.

Potamanthus: Europe, middle and south, 2 sp.; N. America, Virginia, 1 sp. (undescribed).

Rhoënanthus: Dutch East Indies, 1 sp.

Atalophlebia: Australia, 6 sp.; New Zealand, 3 sp.; Chili, 1 sp.; Ceylon, 4 sp.; Cape of Good Hope, 1 sp.; Japan (undescribed).

Leptophlebia: Europe, 5 sp. (one of them ranging into Turkestan); temperate N. America, 6 sp. and others undescribed; Chili, 1 sp. (undescribed).

Blasturus: temperate N. America, 1 sp.; Scandinavia, perhaps 1 sp.

Choroterpes: continental Europe, 1 sp.; Arizona, 1 sp. (undescribed).

Thraulus: southern Europe, 1 sp.; Indo-Malayan region, 2 sp.; tropical America, 4 sp. and others undescribed. Probably well represented in hot climates.

Adenophlebia: Cape Colony, 1 sp.

Hagenulus: Cuba, 1 or 2 sp.

Habrophlebia: temperate and southern Europe, 6 sp.; New Hampshire (undescribed).

Calliarcys: southern Europe, 1 sp.

Ephemerella: Europe, 3 sp.; N. America, 6 sp.; Japan, 1 sp.; China, 1 sp. (undescribed). Several nameless genera related to this are found in N. America.

Teloganodes: Ceylon, 2 sp.

Tricorythus: Egypt, 1 sp.; Malay Archipelago (undescribed); Cape Colony, 1 sp.; perhaps south of France, 1 sp.

Leptohyphes: Argentine Republic, 1 sp.

Cœnis: Europe, 8 or 9 sp.; Egypt, 1 sp. (undescribed); Morocco, 1 sp. (undescribed); Lake Nyassa, 2 sp.; Cape Colony, 1 sp. (undescribed); Ceylon, 1 sp.; N. America, 2 sp. and several others undescribed.

Prosopistoma: middle and southern Europe, 1 sp.; Madagascar, 1 sp. (Fly undescribed.)

Baëtis: Europe, 14 sp., one of them ranging to Madeira and the Canaries, another to Canada, also one undescribed; Greenland, 1 sp. (?); Egypt, 1 sp. (undescribed); N. America, 6 sp. and upwards; central and S. America, 2 sp. or perhaps 3; Indo-Malay region, 3 or more sp.; Australia (undescribed). A kindred genus is known by the nymph from Peru.

Centroptilum: Europe, 8 sp., one of them ranging into Canada; N. America, Arizona, 1 sp. (undescribed); Cuba, 1 sp.

Cloëon: Europe, 5 sp., one of them ranging eastward to Armenia and Japan, and southwestwards to Madeira and Teneriffe; Indo-Malay region, 4 sp. (one undescribed); China, 1 sp., perhaps a European; Australia, 1 sp. (undescribed); Cape Colony, 1 sp. (undescribed); N. America, 3 sp.; Argentine Republic, perhaps 1 sp.; Chili, 1 sp. (undescribed).

Callibætis: throughout America; N. America, 3 or 4 sp. and 1 undescribed (one of the former ranging southwards to Central America); Cuba and Central America, 3 or 4 sp. (one undescribed); S. America, 2 sp.; Australia, 1 sp. (undescribed).

Coloburiscus: Australia, 1 sp.; New Zealand, 1 sp.; N. America, 1 sp. (undescribed).

Chirotonetes: Europe, 1 sp.; N. America, 4 sp.

Metamonius: Chili, 1 sp.

Ameletus: Europe, 1 sp.; N. America, 3 sp.

Dipteromimus: Japan, 1 sp.

Siphlurus: Europe, upwards of 4 sp.; N. America, 6 sp. (the genus is probably represented by many other species); E. Amurland, 1 sp.; Japan, 1 sp. (undescribed); New Zealand, perhaps 1 sp.

Oniscigaster: New Zealand, 1 sp.

Batisca: N. America, 1 sp.

Gen. ——. A remarkable nymph from Chili [Pl. LIII.] is worthy of mention here.

Ametropus: Europe, 1 sp., perhaps ranging to the Caucasus and Armenia.

Atopopus: Borneo, 1 sp.

Thalerosphyrus: Java and the Philippines, 2 sp.

Epeorus: Europe, 4 sp.; Armenia, 1 sp. (undescribed); Himalaya, 1 sp. (provisionally included); N. America (undescribed).

Bleptus: Japan, 1 sp.
Iron: Western N. America, 2 sp.; Central America (undescribed).
Cinygma: Western N. America, 4 sp.
Rhithrogena: Europe, 7 sp. and upwards; N. America, 5 sp.
Pægniodes: China, 1 sp.; Tibet, 1 sp. (undescribed).
Heptagenia: Europe, 4 sp., two of them ranging to E. Amurland, and one undescribed from Segovia; N. America, 2 sp., and probably many undescribed.
Compsoneuria: Malay region, 1 sp.
A kindred genus in N. America (undescribed) may here be enumerated.
Ecdyurus: N. America, 4 sp.; Europe, 12 sp.; the Caucasus, Mesopotamia, Himalaya, and Siberia (undescribed).

The *Ecdyurus* type of genera is represented in Cape Colony. An undescribed ♀ specimen of a species taken by Mr. R. Trimen at Paarl, and now in M'Lach. Mus., has a superficial likeness to species of *Heptagenia*, but differs therefrom in the proportions of its legs. Some small undescribed species, not referable to *Compsoneuria*, and of undetermined genus, natives of the Malay region, are represented in a Leyden Collection.

In this volume 55 genera and 270 species of recent *Ephemeridæ* are characterized, in addition to 11 nameless nymphs, and 19 species named by other authors, which cannot now be classified exactly. Amongst them, 5 genera and 68 species were new to science, and 13 of the older species had to be renamed.

A Conspectus of the Classification adopted in this volume prefaces at pp. 21–22 the systematic description of the *Ephemeridæ*. I now bring it to a close with an analysis of the Groups, &c., therein set forth. The tabulated characters apply solely to adult insects, and are selected from fuller particulars given at the pages that are indicated, to which reference should be made.

Analysis of the Groups, Series, Sections, and Genera.

Family EPHEMERIDÆ (p. 2).

1 . . . . **Group I.** (p. 22). At the roots of the mesothoracic wing the Anal (8) nervure meets the Pobrachial (7) nervure; and, when axillar nervures are developed, the 1st Axillar (9′) meets the Anal nervure. Hinder tarsi usually 4-jointed; when a fifth joint is traceable, it is only very short, and is intimately blended with the tibia 2

„ . . . . **Group II.** (p. 77). At the roots of the mesothoracic wing [except in Series 1 and 3] the Anal (3) nervure communicates only indirectly with the Pobrachial (7) nervure, through an obsolete channel of circulation, discernible in the wing-membrane. Legs all functional [except, perhaps, in *Prosopistoma*]. Hinder tarsi usually 4-jointed; a very short fifth joint is sometimes intimately blended with the tibia 3

„ . . . . **Group III.** (p. 199). At the roots of the mesothoracic wing the Anal (8) nervure is separate from the Pobrachial (7) nervure, but a channel of circulation is traceable between them in the wing-membrane; the 1st Axillar, detached from its own group of nervures, either meets or approaches the Anal (8) nervure. Hinder tarsi distinctly 5-jointed 4

2 . . . . Series 1 of Group I. (p. 22). Legs of ♀ short and feeble, when not atrophied and functionless. Hind leg of ♀ longer than the fore leg. Eyes of ♂ evenly contoured 5

„ . . . . Series 2 of Group I. (p. 47). Legs of ♀ all functional. Fore leg of ♀ at least as long as the hind leg, and usually rather longer. Eyes of ♂ evenly contoured 6

3 . . . . Series 1 of Group II. (p. 77). At the roots of the fore wing the Anal (8) nervure approaches or meets the Pobrachial (7) and is met by the 1st Axillar (9^1) which distally describes a bold curve. Forceps-basis of ♂ and lobe of the 9th ventral segment of ♀ developed. Eyes of ♂ evenly contoured . . . 7

„ . . . . Series 2 of Group II. (p. 81). At the roots of the fore wing the Anal (8) nervure is quite separate from the Pobrachial (7): the 1st Axillar (9^1) usually describes a simple curve which is strongly arched distally; but sometimes close to the wing-roots, from certain points of view, it appears to be continued forwards along the crease in the wing-membrane so as to curve abruptly towards the Anal (8) nervure, and then it may be termed ogee*-curved. Forceps-basis of ♂ and lobe of the 9th ventral segment of ♀ developed. Eyes of ♂ ascalaphoid 8

„ . . . . Series 3 of Group II. (p. 136). At the roots of the mesothoracic wing the Anal (8) and Pobrachial (7) nervures lie close alongside of each other, or in mutual contact, apart from the Axillar (9) nervures. Præbrachial (6) nervure forked. Eyes of ♂ evenly contoured and far asunder 9

„ . . . . Series 4 of Group II. (p. 153). At the roots of the mesothoracic wing the Anal (8) nervure is quite separate both from the Pobrachial (7) and the 1st Axillar (9^1) nervure. The 1st Axillar nervure is gently curved, and the Præbrachial (6) nervure is essentially simple. Forceps-basis of ♂ and lobe of the 9th ventral segment of ♀ undeveloped. Eyes of ♂ divided into two unequal segments; the upper segment is large and turbinate, the lower small and oval. 10

4 . . . . Series 1 of Group III. (p. 199). The Anal-Axillar interspace [in *Bætisca* the 2nd Axillar space] of the fore wing includes the anal angle and the outer half of the inner margin. The Anal (8) nervure [in *Bætisca* the 2nd Axillar (9^2)] is less curved than the 1st Axillar (9^1) [in *Bætisca* the 3rd Axillar (9^3)], and its numerous branchlets meet the outer half of the inner margin . . 11

„ . . . . Series 2 of Group III. (p. 229). Adult unknown 12

* Ogee or ogive, an architectural term, signifies the sinuate curve shown in vertical section of the side of a vase or cup that is rounded at the base and everted at the rim.

„ . . . . Series 3 of Group III. (p. 230). The Anal-Axillar interspace of the fore wing includes the anal angle and part of the terminal margin, and it contains a variable number of longitudinal intercalar nervures [usually four] which are commonly disposed in two couples of unequal length: of these the couple next to the 1st Axillar (9^1) nervure is the longest 13

5 . . . . Section 1 (p. 22). Subcosta of the fore wing, when developed, retired somewhat in a fold of the membrane under the Radius (3). Palingenia Type 14

„ . . . . Section 2 (p. 26). Subcosta of the fore wing displayed (except in the dried ♀ *Campsurus*) . . . . . Polymitarcys Type. 19

6 . . . . Section 3 (p. 48). In the fore wing the Anal (8) and essentially simple 2nd Axillar (9^2) nervures bound a semi-sagittate space. [Compare Section 4, *infra*.] Forceps-basis of ♂ developed; basal joints of the limbs shorter than the next joints: lobe of the 9th ventral segment of ♀ undeveloped.

Ephemera Type. 21

7 . . . . Section 4 (p. 78). In the fore wing the Anal (8) and forked 2nd Axillar (9^2) nervures bound a semi-sagittate space. Basal joint of ♂ forceps-limb the longest of all. [Compare section 3 *supra*.] . . . . . Potamanthus Type. 22

8 . . . . Section 5 (p. 82). In the fore wing the Anal (8) and simple 2nd Axillar (9^2) nervures bound a trilateral somewhat leg-of-mutton-shaped space. The 1st Axillar (9^1) at its proximal extremity, where it meets the transverse crease in the wing-membrane, is nearer to the 2nd Axillar than to the Anal nervure. [In *Hagenulus* the 1st Axillar meets the 2nd Axillar nervure.]

Leptophlebia Type. 23

„ . . . . Section 6 (p. 122). In the fore wing the Anal (8) and simple 2nd Axillar (9^2) nervures bound a curved trilateral space, truncate at its narrow end. The Anal (8) and 1st Axillar (9^1) nervures converge, and at the base of the wing lie close together, or in mutual contact, apart from the 2nd Axillar and from the Pobrachial (7) nervure . . . . . Ephemerella Type. 31

9 . . . . Section 7 (p. 137). In the mesothoracic wing the Anal (8) and 2nd Axillar (9^2) nervures bound a curved trilateral space, truncate, or abrupt at its narrow end. Hind wings absent . . . . . Cænis Type. 32

„ . . . . Section 8 (p. 149). Wing-neuration imperfectly elucidated. Hind wings developed . . . . . Prosopistoma Type. 34

10 . . . . Section 9 (p. 153). In the mesothoracic wing the Anal (8) and 2nd Axillar nervures bound a trilateral, somewhat leg-of-mutton-shaped space, abrupt at its narrow end. Hind tarsus $\frac{1}{2}$ to $\frac{3}{4}$ the length of the tibia, 4-jointed, with the proximal joint long . . . . . Baëtis Type. 35

11 . . . . Section 10 (p. 200). In the fore wing the Anal (8) nervure terminates close by the anal angle; the 1st Axillar (9^1) nervure terminates in or before the middle of the inner margin. Pronotum well developed . . Siphlurus Type. 37

„ . . . . Section 11 (p. 226). In the fore wing the Anal (8) and the 1st Axillar

(9^1) nervures run almost parallel with one another to the terminal margin; and between these nervures and the anal angle, the 2nd Axillar (9^2) intervenes. Pronotum of minimum proportions . . . . . Bætisca Type. 42

12 . . . . Section 12 (p. 229). Adult unknown . . . . . .

13 . . . . Section 13 (p. 230). Hinder tarsi as long as the tibiæ, or longer. In the fore wing the 1st Axillar (9^1) is almost parallel with, and is near the 2nd Axillar (9^2) nervure, and it approaches the anal angle . . . Atopopus Type. 43

„ . . . . Section 14 (p. 233). Hinder tarsi shorter than the tibiæ. In the fore wing the 1st Axillar (9^1) nervure seldom approaches the anal angle so nearly as in Section 13 . . . . . Ecdyurus Type. 45

Palingenia Type.

14 . . . . Axillar nervures well developed in the fore wing; wing-neuration plentiful; wing-membrane translucent but dull 15

„ . . . . Axillar nervures obsolescent or wanting in the fore wing; wing-neuration scanty 16

15 . . . . Præbrachial (6) nervure of the fore wing forked beyond the middle; two conspicuous couples of longitudinal nervures proceed to the terminal margin . . . Subgen. *Palingenia* [(p. 23).

„ . . . . Præbrachial nervure of the fore wing forked before the middle; three conspicuous couples of longitudinal nervures proceed to the terminal margin . . . Subgen. *Anagenesia* [(p. 25).

16 . . . . Wing-membrane dull or satin-like 17

„ . . . . Wing-membrane "shot" with blue or purple 18

17 . . . . Fore wing apparently 5-nerved, with the 5th nervure forked . . . . . *Oligoneuria* (p. 29).

„ . . . . Fore wing apparently 3-nerved, with the 2nd and 3rd nervures forked. . . . . *Elassoneuria* (p. 32).

18 . . . . Fore wing apparently 5-nerved, with the 4th and 5th nervures forked . . . . . *Spaniophlebia* (p. 33).

„ . . . . Fore wing apparently 4-nerved, with 1st, 3rd, and 4th nervures forked . . . . . *Lachlania* (p. 34).

„ . . . . Fore wing apparently 4-nerved, with every nervure simple . . . . . *Homœoneuria* (p. 35).

Polymitarcys Type.

19 . . . . The Anal-Axillar interspace of the fore wing contains numerous sinuate or ogee-curved branchlets of the Anal (8) nervure which run transversely to the inner margin. Setæ 3 . . . . . *Euthyplocia* (p. 36).

„ . . . . The aforesaid interspace contains two longitudinal intercalar nervures or branches of the Anal (8) nervure, and very few cross-veinlets. Setæ 2 . . . . *Campsurus* (p. 38).

„ . . . . A nameless insect differs from *Campsurus* in having an abundance of cross-veinlets . . . . . Plate VI. 8 bis.

„ . . . . The aforesaid interspace contains 4 or 5 longitudinal intercalar nervures, and an abundance of cross-veinlets 20

20 . . . . . Setæ ♂ 2 . . . . . *Jolia* [?] (p. 42).

„ . . . . Setæ ♂ 2, ♀ 3 . . . . . *Polymitarcys* (p. 43).

Ephemera Type.

21 . . . . Median caudal seta very short and rudimentary in both sexes. Pronotum of ♀ longer than broad; fore tarsus of ♀ subequal in length to the tibia . . . . . *Hexagenia* (p. 48).

„ . . . . Median seta subequal to the others in both sexes. Pronotum of ♀ somewhat transverse; fore tarsus of ♀ about $\frac{3}{4}$ as long as the tibia . . . . . *Ephemera* (p. 58).

„ . . . . Median seta very short and rudimentary in the ♂, but long and little shorter than the others in the ♀. Pronotum of ♀ transverse; fore tarsus of ♀ scarcely $\frac{2}{3}$ as long as the tibia . . . . . *Pentagenia* (p. 75).

Potamanthus Type.

22 . . . . Median caudal seta long in both sexes . . . . *Potamanthus* (p. 78).

„ . . . . Median seta aborted in both sexes . . . . . *Rhoënanthus* (p. 81).

Leptophlebia Type.

23 . . . . Tarsal claws all narrow and uncinate 24

„ . . . . Of every tarsus one claw is broad and obtuse, the other claw narrow and uncinate 25

24 . . . . Hind wing more or less obtusely subovate . . . *Atalophlebia* (p. 83).

„ . . . . Hind wing oblong, oblique; its marginal area abbreviated and relatively very broad . . . . . *Adenophlebia* (p. 111).

25 . . . . Hind wing obtusely ovate or oval; its marginal area narrow throughout and far extended 26

„ . . . . Hind wing strongly angulated in front; its marginal area broad and usually abbreviated 27

26 . . . . Median caudal seta equal to the others . . . . *Leptophlebia* (p. 91).

„ . . . . Median seta much shorter than the others . . . *Blasturus* (p. 100).

27 . . . . At the roots of the fore wing the 1st Axillar (9^1) meets the 2nd Axillar nervure . . . . . *Hagenulus* (p. 113).

„ . . . . At the roots of the fore wing the 1st Axillar is separate from the 2nd Axillar nervure 28

28 . . . . In the Anal-Axillar interspace of the fore wing

if there are more than two intercalar nervures, that which is next to the Anal (8) nervure is long. Lobe of the 9th ventral segment of ♀ obtuse 29

„ . . . . If there are more than two intercalar nervures in the said interspace, that which is next to the Anal (8) nervure is short or rudimentary. Lobe of the 9th ventral segment of ♀ bifid and acutely excised 30

29 . . . . Basal joint of the ♂ forceps-limb very short; 2nd joint by far the longest . . . . . *Choroterpes* (p. 104).

„ . . . . Basal joint of the ♂ forceps-limb by far the longest . . . . . *Thraulus* (p. 106).

30 . . . . Basal joint of the ♂ forceps-limb nearly as long as the remainder of the limb . . . . . *Habrophlebia* (p. 114).

„ . . . . Basal joint of the ♂ forceps-limb longer by far than the remainder . . . . . *Calliarcys* (p. 121).

Ephemerella Type.

31 . . . . Median caudal seta long. Hind wing well proportioned, and with copious neuration: subcosta arched and long. Basal joint of the ♂ forceps-limb shorter by far than the 2nd joint . . . . . *Ephemerella* (p. 124).

„ . . . . Median seta aborted. Hind wing minute and with scanty neuration: subcosta straight and abbreviated. Basal joint of the ♂ forceps-limb rather longer than the 2nd joint . . . . . *Teloganodes* (p. 134).

Cænis Type.

32 . . . . Cross-veinlets of the wing pluriserial 33

„ . . . . Cross-veinlets uniserial. Median caudal seta long . . . . . *Cænis* (p. 141).

33 . . . . Median seta long . . . . . *Tricorythus* (p. 138).

„ . . . . Median seta aborted . . . . . *Leptohyphes* (p. 140).

Prosopistoma Type.

34 . . . . Median caudal seta developed . . . . . *Prosopistoma* (p. 149).

Baëtis Type.

35 . . . . Hind wings small or minute 36

„ . . . . Hind wings absent . . . . . *Cloëon* (p. 179).

36 . . . . Hind wing oblique, elongate, narrow, and bi-nerved, with usually a slender costal projection . . . *Centroptilum* (p. 174).

„ . . . . Hind wing oblique, usually rather broad and obtusely ovate, bi- or tri-nerved, with usually a small and acute costal projection . . . . . *Bætis* (p. 156).

„ . . . . Hind wing oblique, usually rather broad and oblong, tri-nerved, with several cross-veinlets in at least the marginal area, and with a large and very obtuse costal protuberance . . . . . *Callibætis* (p. 191).

Siphlurus Type.

37 Hind tarsus shorter than the tibia 38

„ Hind tarsus longer than the tibia 41

38 . . . . Proximal joint of the hind tarsus distinctly shorter than the next joint 39

„ . . . . Proximal joint of the hind tarsus hardly perceptibly shorter than the next joint. Of every tarsus one claw is blunt and the other hooked . . . . . *Ameletus* (p. 210).

„ . . . . Proximal joint of the hind tarsus longer than the next joint. Tarsal claws all narrow and hooked. Hind wings minute . . . . . *Dipteromimus* (p. 213).

39 . . . . Of every tarsus one claw is blunt and the other hooked . . . . . *Coloburus* (p. 201).

„ . . . . Claws of the hinder tarsi, and usually of the fore tarsus also, all narrow and hooked 40

40 . . . . Axillar region of the hind wing ample, containing numerous long branchlets of the 2nd Axillar nervure. Claws of the ♂ fore tarsus peculiar in form . . . . *Chirotonetes* (p. 203).

„ . . . . Axillar region of the hind wing small and narrow; 2nd Axillar nervure of the same almost branchless . . . . . *Metamonius* (p. 208).

41 . . . . Proximal joint of the hind tarsus longer than the next joint. Tarsal claws all narrow and hooked . . . *Siphlurus* (p. 214).

„ . . . . Proximal joint of the hind tarsus likewise longer than the next joint. Of every tarsus one claw is blunt and the other hooked . . . . . *Oniscigaster* (p. 223).

Bætisca Type.

42 . . . . Hind tarsus longer than the tibia; its proximal joint longer than the next joint. Of every tarsus one claw is blunt and the other hooked . . . . . *Bætisca* (p. 226).

Atopopus Type.

43 . . . . Axillar region of the hind wing ample and with

copious neuration. Hind tarsus probably rather longer than the tibia. Median caudal seta long . . . . . *Ametropus* (p. 231).

„ . . . . Axillar region of the hind wing small, narrow, and with sparse neuration. Median caudal seta aborted 44

44 . . . . Hind tarsus of ♂ twice the length of the tibia . *Atopopus* (p. 232).

„ . . . . Hind tarsus of ♂ equal in length to the tibia . *Thalerosphyrus* (p. 232).

Ecdyurus Type.

45 . . . . First joint of the hind tarsus longer than the second; the second joint longer than the third 46

„ . . . . First joint of the hind tarsus equal to the second joint 48

„ . . . . First joint of the hind tarsus shorter than the second joint 50

46 . . . . First joint of the fore tarsus rather longer than the second joint. Hind wings unusually small . . . *Bleptus* (p. 243).

„ . . . . First joint of the fore tarsus equal to the second joint. Hind wings well developed . . . . . *Epeorus* (p. 237).

„ . . . . First joint of the fore tarsus shorter than the second joint. Hind wings well developed 47

47 . . . . Penis-lobes (when dried) narrow and shrunk to peg-like projections. Femora sometimes without markings, sometimes faintly banded . . . . . *Cinygma* (p. 247).

„ . . . . Penis-lobes (when dried) stout, dilated at their extremities. Cross-veinlets scarce in the fore wings. Femora banded . . . . . *Compsoneuria* (p. 275).

„ . . . . Penis-lobes stout, usually transversely and broadly dilated at their extremities, but sometimes obovate. Cross-veinlets abundant in the fore wings. Femora often banded, but sometimes without markings *Ecdyurus* [part] (p. 276).

48 . . . Second joint of the hind tarsus equal to the third joint. Femora usually marked with a dark median spot, but banded in one species and without markings in another . . . . . *Iron* (p. 244).

„ . . . . Second joint of the hind tarsus longer than the third joint 49

49 . . . . Penis-lobes (when dried) narrow and shrunk to peg-like projections. Femora usually marked with a dark median spot or streak, but sometimes without markings . . . . . *Rhithrogena* (p. 250).

„ . . . . Penis-lobes stout and broadly dilated at their extremities, or obovate. Femora often banded, but sometimes without markings . . . . . *Ecdyurus* [part] (p. 276).

50 . . . . Second joint of the hind tarsus equal to the third joint 51

„ . . . . Second joint of the hind tarsus longer than the third joint 52

51 . . . . Penis-lobes somewhat explanate and oblong, subtruncate at their divergent extremities. Femora usually without markings, but sometimes faintly banded . . . *Heptagenia* [part] (p.265).

„ . . . . Penis-lobes broad and short. Femora banded . *Heptagenia* [part] (p.267).

„ . . . . Penis-lobes narrow and subcylindrical at their bases, with suddenly enlarged patulous tips. Femora without markings . . . . . *Pægnoides* (p. 261).

52 . . . . Femora usually without markings, &c. [See 51 above.] . . . . . *Heptagenia* [part] (p.265).

„ . . . . Femora usually marked with a dark median spot or streak, &c. [See 49 above.] . . . . . *Rhithrogena* [part] (p.250).

Analytical Index to the Descriptions and Illustrations of Nymphs of *Ephemeridæ* contained in this Volume.

1. Palpi of maxilla II biarticulate 2

.. „ „ triarticulate 7

.. „ „ pluriarticulate, flagellate, each consisting of a long, stout basal joint and a slender, multiarticulate flagellum. Seven pairs of abdominal tracheal branchiæ: the foremost different in shape from the others. A nameless S. American nymph . . . . . p. 229, Pl. LIII.

2. Basal joint of the palpus of maxilla II shorter than the other joint. Palpus of maxilla I also biarticulate 3

.. Basal joint of the palpus of maxilla II subequal in length to the other joint. Palpus of maxilla I triarticulate. Median lobe of tongue excised. Seven pairs of abdominal tracheal branchiæ; the foremost branchiæ rudimentary, minute and fringeless; the other branchiæ ciliate or fimbriate. Habits fossorial 6

.. Basal joint of the palpus of maxilla II longer than the other joint, which is peculiarly pouched. Palpus of maxilla I likewise biarticulate. Seven pairs of abdominal tracheal branchiæ. Lobes of the labium more or less distant from one another. Type of *Ecdyurus*.

See Tabulation at p. 235, Pls. LIV.–LXII.

3. Laminæ of at least the hinder pairs of the abdominal tracheal branchiæ jugate, narrow, conduplicate lengthwise and fringed. Habits fossorial 4

.. Laminæ of the abdominal tracheal branchiæ all single, broad, somewhat plane, fringeless, and each provided at its base with a fascicle of fibrils. Habits predaceous 5

4. Six pairs of abdominal tracheal branchiæ all of uniform make. Median lobe of tongue acute. Mandibles strong and short . . . . . *Palingenia*, pp. 23 & 25, Pl. XXV.

.. Seven pairs of abdominal tracheal branchiæ; the foremost, unlike the others, is rudimentary, minute, single and spathulate. Median lobe of tongue obtuse. Crown of mandible prolonged into a slender tusk in advance of the head . . . . . *Polymitarcys*, p. 44, Pl. XXVIII.

5. Seven uniform pairs of abdominal tracheal branchiæ, the foremost ventral: laminæ small, coriaceous, subrotund. Median lobe of tongue acute. Maxillæ II coherent, enclosing and intimately adherent to the labium. At maturity the space between the wings and the peak of the mesonotum is spanned over by membrane sheathing the base of the dorsum.

Oligoneuria, p. 29, Pl. XXVI.

.. Seven uniform latero-dorsal pairs of abdominal tracheal branchiæ; the laminæ well developed, foliaceous, and somewhat obovate. Labium and terminal margins of the fore wings free. Median lobe of tongue obtuse. Caudal setæ natatorial . . . . . *Jolia*, p. 42, Pl. XXVII.

6. Frons armed anteriorly with a single obtuse median protuberance. Tusks of mandibles connivent when closed together . . . . . *Hexagenia*, p. 48, Pls. XXIX. & LXIII. (part).

.. Frons armed anteriorly with two acutely conical projections. Tusks of mandibles overlapping at the points when closed together . . . . . *Ephemera*, p. 58, Pl. XXX.

7. Palpus of maxilla I quadriarticulate *. Maxillæ II concrete with the labium, which is undivided. General form testudinate, broadly ovate, flattened beneath and highly convex dorsally. Caudal setæ plumose, very short, retractile with the last segment. Tracheal branchiæ concealed by a large notal shield in which the anterior wings are immersed at maturity.

Prosopistoma, p. 149, Pl. XLIII.

.. Palpus of maxilla I triarticulate 8

.. „ „ apparently † biarticulate [but if triarticulate,—Mandibles short. Lacinia of maxilla I curved externally from the point to the insertion of the palpus, which is longer than it. Seven pairs of abdominal tracheal branchiæ. Lobes of the labium narrow &c.,—*cf.* §18 below]. Tracheal branchiæ all foliaceous and double, with unequal divisions.

Callibætis, p. 191, Pl. XLVIII.

8. Mandibles short 9

.. „ prolonged beyond the head into slender incurved tusks. Six uniform pairs of abdominal tracheal branchiæ: the laminæ jugate, narrowly lanceolate, conduplicate lengthwise and fringed. Median lobe of tongue excised. Frons unarmed anteriorly.

Euthyplocia, p. 37, Pl. XXIX. (part).

9. Lacinia of maxilla I truncate for some distance outwards from the point; consequently, between the point and the insertion of the palpus, the exterior contour of the lacinia is angular: a conspicuous dense patch of suberect hair occupies some part or the whole of the truncated edge: palpus longer than the lacinia 10

.. Lacinia of maxilla I curved or irregularly rounded off from the point to the insertion of the palpus 14

10. Six pairs of abdominal tracheal branchiæ, all of uniform make; each branchia consisting of two jugate, elongate-oval, plumose or pinnately parted laminæ, with crowded subulate segments

Potamanthus, p. 78, Pl. XXXI.

.. Seven pairs of abdominal tracheal branchiæ 11

11. Tracheal branchiæ uniform 12

.. Foremost tracheal branchiæ quite different in form from the other pairs 13

12. Tracheal branchiæ bipartite, with subulate or linear-lanceolate divisions.

Leptophlebia, p. 92, Pl. XXXII.

* The basis or place of insertion of the palpus might in many instances be easily mistaken for a joint (*e.g.* in *Siphlurus*, Pl. L).

† The number of joints could not be positively ascertained from the specimens examined. Even the figure published is suggestive of there being possibly a very short third joint at the tip of the palpus; but no joining was traceable thereabouts in the actual object.—A. E. E.

.. Tracheal branchiæ bifid, with filiformly dissected divisions . . *Habrophlebia*, p. 115, Pl. XXXVI.

13. Foremost tracheal branchiæ bifid, with linear-lanceolate divisions: the others consist of jugate, obliquely subovate, tail-pointed, fringeless, foliaceous laminæ. *Blasturus*, p. 100, Pl. XXXIII.

.. Foremost tracheal branchiæ single, linear-lanceolate; the others composed each of two jugate, unequal, cuspidate, foliaceous laminæ, oblique at the base, of which laminæ the smaller is obliquely ovate, and the larger obliquely subcordate-ovate, with unequal auricles: the cusps are discontinuous with the blades of the laminæ . . . . . *Choroterpes*, p. 105, Pl. XXXIV.

.. Foremost tracheal branchiæ bipartite, with filiform divisions: the others composed each of two jugate, oblong-ovate, fimbriate, foliaceous laminæ . . . . . *Thraulus*, p. 107, Pl. XXXV.

14. Four or five pairs of abdominal tracheal branchiæ. Palpus of maxilla 1 shorter than the lacinia 15

.. Six pairs of abdominal tracheal branchiæ. Palpus of maxilla 1 longer than the lacinia . . 16

.. Seven pairs of abdominal tracheal branchiæ. Palpus of maxilla 1 equal in length to, or longer than, the lacinia 18

15. Pronotum well developed. Palpi of maxillæ 11 simply pointed. Hinder tracheal branchiæ each composed of a lamina, concave on the underside, sheltering a partly adherent forked appendage beset with membranous lamellæ. At maturity triangular membranes extend from the terminal margins of the fore wings to the peak of the mesonotum. Type of *Ephemerella*.
See Tabulation, p. 123, Pls. XXXVII.–XL. & LXIV. (part).

.. Pronotum reduced to a minimum. Palpi of maxillæ 11 forcipate. Tracheal branchiæ at maturity concealed by a large mesonotal shield, in which the fore wings are immersed.
Bætisca, p. 226, Pl. LII.

16. Foremost tracheal branchiæ rudimentary, subulate; the second pair elytroidal, sheltering the hinder pairs, the laminæ of which are fimbriate 17

.. Abdominal tracheal laminæ imbricate, all lamellar and pergamentose: the foremost is triangular-obovate in form; each of the other laminæ is somewhat oval, with a large rounded foliated, eroded and laciniate lobe produced from its interior margin. Abdominal pleura oniscoidally dilated . . . . . *Oniscigaster*, p. 224, Pl. LI.

17. Laminæ of the hinder pairs of tracheal branchiæ each furnished on the underside with a filamentosely dissected appendage . . . . . *Tricorythus* (?), p. 138, Pl. XLI.

.. Hinder tracheal branchiæ unprovided with any appendage . . . . . *Cænis*, p. 141, Pl. XLII.

18. Lobes of the labium broad and obtuse. Pleura of the intermediate abdominal segments more or less narrowly dilated oniscoidally 19

.. Lobes of the labium narrow and acute or falcate. Pleura of the intermediate abdominal segments hardly at all produced.—Type of *Baëtis* . . See Tabulation, p. 155, Pls. XLV.–XLVIII.

19. Abdominal tracheal branchiæ all single and obovate. Palpus of maxilla 1 subequal in length to the subquadrate lacinia, the crown of which is singularly beset with suberect pectinate spinules.
Chirotonetes (?), p. 204, Pl. XLIX.

.. Abdominal tracheal branchiæ of the first two pairs, each formed of two foliaceous laminæ connate at the base: the laminæ of the other pairs are single. Palpus of maxilla 1 longer than the lacinia, which is longer than broad . . . . . *Siphlurus*, p. 215, Pl. L.

ADDITIONS AND CORRECTIONS.

Page 4, line 3 from top, *after* "forms" *read* also in *Leptohyphes* and in the subimago (not the adult) of *Ephemerella*, it is there, &c.

P. 20, l. 17 from top, before "*Bætisca*" insert *Cloëon*, *Baëtis* (with three sections).

P. 21, l. 2 from bottom, *for* "Serie" *read* Series.

P. 22, l. 11 from bottom, *dele* "al" so as to *read* functionless.

P. 36, l. 18 from bottom, *for* "Section 2 of the Genus" read *Section 2 of the Genera.*—

P. 81, l. 12 from bottom, for "*Hagenulus*" read *Teloganodes*.

P. 95, l. 8 from bottom, *add* Mr. Albarda has lately sent me specimens representing both sexes of the imago and the ♂ subimago of *L. Meyeri* captured in the Netherlands at Ginneken, N. Brabant, and at Arnhem, Guelderland, which I returned to him undescribed a few years ago.

P. 101, l. 15 from top, *after* "172 (1863)" *add* ; Walsh, *op. cit.* ii. 189 note 14, and 194 note 15 (1863).

P. 101, l. 18, *after* [details] *add*; Packard, in 3rd Rep. U.S. Ent. Comm. chap. xi. (part), pls. xlv.–xlvi. [morphology] (1883).

P. 106, l. 10 from top, *after* Italy *read* Spain. Again, *after* "Portugal," *add* A specimen from San Ildefonso, Segovia (*Meyer-Dür*) is in Mr. Albarda's collection.

P. 109, l. 4 from top, *for* Palenburg *read* Palembang.

P. 114, l. 9 from top, *for* nodal point *read* bulla.

P. 122, l. 1, *before* Algarve *read* Spain.

P. 122, l. 14, *after* grey *add* ; neuration in opaque view concolorous with the membrane.

P. 122, l. 13 from bottom, *add* A single ♀ subimago, considerably damaged by *Anthrenus*, from San Ildefonso, Segovia (*Meyer-Dür*), in Mr. Albarda's collection has the wing 8·5 mm. long.

P. 124, l. 2 from bottom, *before* Guard *insert* The recurrent membrane of the fore wing-roots extends in the form of short subulate points beyond the peak of the scutellum in the *subimago*; but these mesonotal appendages are wanting in the *imago*.

P. 139, l. 13 from bottom, *add* In translating the description of this species in 1871, I carelessly wrote ventralibus for dorsalibus.

P. 141, l. 2 from bottom, *for* "Homologue of the forceps-basis undeveloped in ♀," *read* Ventral lobe of ♀ segment 9 obtusely rounded off and entire.

P. 143, l. 2 from bottom, *for* var. RIVULORUM *read* CÆNIS RIVULORUM, sp. nov.

P. 144, l. 8, to the localities quoted, *add* Also the Eden in Cumberland; profusely abundant at Langwathby on certain evenings towards sunset so as to produce an appearance as of mist or dense haze hovering over the course of the river. A single Scotch specimen is in Mr. King's collection.

P. 160, l. 2 from bottom, *after* Brook ; *add* abundant in Briggle Beck and in the Eden near Little Salkeld in Addingham, Cumberland;

P. 186, l. 15 from top, *for* Teneriffe, common near the Jardin, *read* common in a Fonda at Puerto de la Orotava, Tenerife, and near the Jardim.

This relates to Chirotonetes (?) ornatus, p. 208.

Subimago (dried).—Wings whitish grey; fore wings less yellowish at the roots than in *Coloburus humeralis*, having a small yellowish spot at the roots of the subcosta; cross-veinlets bordered with brown-black (corvinous), their bordering confluent here and there into spots producing an irregular chequered appearance amongst the reticulation. Setæ warm sepia-brown, with dark joinings.

Imago (dried).—Notum of ♂ black or pitch-brown; that of ♀ fusco-luteous or brown-ochreous. Dorsum of abdomen rufo-fuscous, with a dark triangular spot behind on each side of every intermediate segment, before the apex of which is an ochraceous space [=? a lateral series of oblique dark stripes each enclosing a pale space]. Setæ fuliginous or warm sepia-grey with darker joinings. Antepenultimate [? ventral] segment of ♀ usually conspicuously paler than the others, and traversed lengthwise by three black lines. Fore legs brown-ochreous, the hinder legs flavescent, with black or dark-grey markings, viz.:—a band in the middle and another at the tip of the femur, the tip of the tibia, the joinings and. to a large or small extent, the last three joints of the tarsus. Wings vitreous; fore wing faintly yellowish or amber-tinted in the first portions of the marginal and submarginal areas, and tinged with brown-black in the pterostigmatic region, where the cross-veinlets are dark-bordered, simple, and straight: neuration for the most part pitch-black, but the subcosta and radius are yellowish towards the base. Length of body 14–15, wing 12–16; setæ ♂ and ♀ im., 16 and 1, subim. ♂ about 13, ♀ 11 mm.

Hab. Christchurch, New Zealand. Easily distinguished from *Coloburus humeralis* by the dark-bordered cross-veinlets of the wings forming here and there irregular blots, by the smaller extent of the yellowish tint at the wing-roots, and by the banded femora. Described and illustrated by me in 1876 after specimens at that time in the M'Lach. Mus.

P. 210, l. 14 from bottom, *add* and Europe.

P. 216, l. 4 from bottom, *add* I have lately seen, in Mr. Albarda's collection, a single ♂ subim. captured by Meyer-Dür at the same place. The Portuguese nymph figured in Pl. L. is probably of this species. These nymphs were plentiful in a streamlet near Saõ Barnabe in Algarve at an altitude of 700 ft. [water 64° F., 12th May, 1880, in the afternoon], and there were sloughs relinquished by the subimago on some of the stones in the stream; but I failed to find the fly.

P. 232, l. 6 from top *add*:—

A fragmentary ♂ imago, probably of this species, forwarded to me, without record of locality, by M. Frey-Gessner, differs from the specimen described at p. 231 *supra* and figured in detail in Pl. XXII. in the following particulars:—Many of the cross-veinlets of the pterostigmatic portions of the marginal areas of the fore wings are forked near the costa and some of them anastomose with one another; the two short intercalary nervures in the anal-axillar interspace of the fore wing, which are next to the 1st axillar nervure, end inwards abruptly; the narrow linguiform penis is entire, not incised at the

tip; the forceps-basis is less deeply emarginate behind; and in segments 8 and 9 the venter is more of a light brown-ochre or "fuscous" in colour. Differences in the state of preservation of the specimens may be held to account sufficiently for most of these discrepancies, and individual idiosyncrasy for the remainder. From the coloration of the abdomen of the adult fly, I am led to infer that the abdominal pairs of tracheal branchiæ of the nymph are seven in number.

P. 233, l. 4 from bottom, *for* tibia *read* tibiæ.

P. 238, l. 12 from bottom, *for* Epeorus geminus, sp. nov., *read* :—

Epeorus sylvicola, Ed. Pictet.

‡ *Baëtis sylvicola*, ! Ed. Pict., Synop. Névropt. d'Espagne, 24, pl. iii. 7–12 (1865).
Heptagenia sylvicola, ! Etn., Trans. Ent. Soc. London (1871), 147.
Epeorus geminus, ! Etn., at p. 238, *supra* (1885).

Subimago (*dried*), ♀.—Wing-membrane sepia-grey; neuration for the most part (in opaque view) pitch-black, the subcosta being so entirely, in both wings, but the proximal ends of the other main longitudinal nervures become light bistre-grey, and the tegulæ are light yellowish: cross-veinlets in both wings narrowly and very faintly bordered with light grey. Setæ intense warm sepia-brown, with black joinings. Length of body, ♂ 12, ♀ 13; wing ♂ 15, ♀ 16 mm.

P. 239, l. 14 from top, after the parenthesis *insert* ; Spain, San Ildefonso, Segovia (Ed. Pict.). M. E. Frey-Gessner lately transmitted to me for examination the type specimens of this species; and I have consequently been able to identify my Portuguese *Epeorus* with Ed. Pictet's ‡ *B. sylvicola*.

P. 239, l. 6 from bottom, *for* 1835 *read* 1885.

P. 239, l. 7, *add* Also the Vosges (Puton, MS.).

P. 242, l. 14 from bottom, *add* Plate LXV. 13 (♂ genitalia).

P. 249, l. 20 from bottom, *for* "anastomo seat all" *read* anastomose at all.

P. 252, after l. 20 from top, *add* :—

Type. *Rh. semicolorata*, Curt.

Distribution. N. America and Europe.

Etymology. ῥεῖθρον, a stream, and γένος.

P. 266, after l. 16 from top, *add* :—

Type. *H. flavescens*, Walsh.

Distribution. Northern Hemisphere from about 30° N. lat. within the Arctic Regions.

Etymology. ἑπτά and γενεά, in reference to the genus being seventh in a series.

The following descriptions refer to the North-American species of *Heptagenia* (*antea*, p. 266).

Since the publication of the descriptions of *H. flavescens* and *H. interpunctata*, p. 266 and p. 267, a large series of the latter species and kindred forms has been added to Mr. M'Lachlan's Collection. I have examined these, and I am led to suspect that the

North-American species differ generically from the European and Asiatic species heretofore described, pp. 268–274.

The descriptions which here follow take cognizance only of the adult and subimago conditions. It may, however, hereafter be found that when the nymph-stage of the American form is fully worked out, the opinions here offered tentatively may require modification.

The following characters of the American species of *Heptagenia* should be taken into consideration with the characters of the genus already given at p. 265.

P. 265. *Adult.*—First joint of the hind tarsus equal or subequal to the third joint; first joint of the ♂ fore tarsus about half as long as the second, and this rather shorter than the third joint; first joint of the ♀ fore tarsus little more than half as long as the second, which is very little shorter than the third joint. Penis-lobes slightly flattened; their extremities roundly truncate.—Fore leg of ♂ about $1\frac{1}{6}$ as long as the body; the tarsal joints, in the order of their shortening, rank in the ♂, 3, 2, 4, 1, 5, and the first is about $\frac{1}{2}$ as long as the second joint; and in the ♀ 3, 2 equal to 5, 1 equal to 4, and the first is $\frac{5}{12}$ as long as the second, or $\frac{1}{2}$ as long as the third joint. The joints of the hind tarsus in the order of their shortening rank in ♂ 2 equal to 3 equal to 5, 1, 4; in ♀ 5, 2 equal to 3, 1, 4, or 1 equal to 4. Ventral lobe of ♀ segment 9 emarginate. Outer caudal setæ of ♂ 3–$3\frac{1}{2}$ the length of the body; those of ♀ $1\frac{1}{2}$–2 its length.

Supplementary to *Heptagenia interpunctata*, see p. 267.

‡ *Baëtis canadensis*, var. (?), ! Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 570 (1853) [?].

Subimago (*dried*).—Wings extremely light yellowish ochre, with neuration at first nearly concolorous with the membrane, and with the extreme edge of the hind wing at the apex and terminal margin blackish grey. The wing-neuration undergoes changes of colour during the maturation of the insect similar in their nature to those described under *Heptagenia sulphurea*, the greater part of it, in specimens very near the last moult, becoming bistre- or raw-umber brown, and only the stronger nervures remaining yellowish in opaque view. In the fore wing the cross-veinlets of the foremost three areas (but not the great cross-vein) are black: the dark pigment in many of the specimens spreads a little, anteriorly, on each side of nearly every cross-veinlet in the marginal area; and in the third of those areas, minute, more or less circular, dark-grey median single spots are similarly apt to be formed upon some or all of the cross-veinlets in the basal half of the area, and where the cross-veinlets are close together near the bulla of the radius two or three of the spots often run together into a dark dash traversing the middle of the cross-veinlets: some of the specimens have none of these spots. In the remainder of the fore wing the cross-veinlets gradually become dark. Setæ uniformly light brownish.

Imago (*dried*), ♂.—Notum light yellowish approaching yellow-ochre, excepting the pronotum, which in some lights approaches pale raw-umber brown; the sides of the thorax are varied with a much paler yellow. Abdomen in segments 1–8 semitransparent greenish white, with the terminal borders of the segments edged evenly and nar-

rowly with bistre-brown on the dorsum, and with a lighter brown on the venter; segments 9–10 and sometimes part of the preceding segment opaque light-yellowish ochre, mingled on the dorsum with a paler yellow. Setæ, in opaque view, uniformly warm sepia-brown. Coxæ concolorous with the thoracic pleura. Fore femur, *in opaque view*, light brownish olive, banded narrowly with blackish in the middle and close to the tip; tibia and tarsus somewhat of a medium sepia-brown, the tibia in some postures, however, assuming the colour of the femur, with the insertion of the tarsus sepia-brown, and the tarsus becoming very light sepia-grey: *in transmitted light* the femur and tibia are a rich translucent yellowish or greenish amber; the tarsus remains dull. Hinder femora and tibiæ paler and more transparent than those of the fore leg; *during life* the pigment forming the femoral markings may perhaps be arranged in bands; but *in dried specimens* these markings consist of a small grey median spot, and another just before the tip, which is small, elongated, and blackish, and is flanked on each side by a very fine abbreviated black line in the edge of the limb. *In some lights* the hinder tarsi, and even the tibiæ also, appear light brownish, or brownish grey; *in other postures* only the tarsal incisures are very narrowly brownish; *in transmitted light* the femora and tibiæ become whitish amber, and the tarsi with (sometimes) the extreme tips of the tibiæ remain dull or blackish grey. Wings vitreous: in the fore wing the membrane of the marginal and submarginal areas, from the base to the beginning of the pterostigmatic region, is, for the most part, sometimes colourless like that of the disk, but usually has a very faint amber tint; the remainder of these areas is suffused distinctly with transparent colouring that varies in tint with change of posture from dull light reddish or reddish brown, to bistre-grey or raw umber-grey, and this colouring extends further along the margin to the extremity of the wing; in the marginal area the same colouring becomes rather faint near the costa. The markings of cross-veinlets in the fore wing are the same in the adult as in the subimago, when there are any at all. Where in the subimago the edge of the hind wing is black, it is not only so in the imago also, but the wing is there bordered narrowly with a bistre-grey cloud, which is shaded off inside and gradually diminishes in width posteriorly. Neuration of the fore wing *in opaque view* pitch-black, excepting the stronger portions of the costa, subcosta, and radius, and also the basal extremities of the other longitudinal nervures, which in some postures appear paler, or light bistre-brown: *in other positions* the neuration altogether, or else only the longitudinal nervures, becomes translucent rufo-piceous. The pterostigmatic nervures are simple and not crowded together.

♀. Very similar to the ♂, especially after oviposition: prior to this, the body is of a richer yellow-ochre in its ground-colouring, and of course the abdomen is not translucent. The marginal and submarginal areas are sometimes almost colourless; sometimes only the latter area, especially in the pterostigmatic region, is slightly amber-tinted, this tint extending onwards along the margin to the extremity of the wing; sometimes both these areas and the colouring continued from them to the tip of the wing are light amber-tinted, and a small reddish cloud lies between the costa and the radius at about $\frac{1}{4}$ of the distance beyond the bulla towards the tip; sometimes the reddish tint is as

extensively diffused in the pterostigmatic region as it is in most specimens of the other sex. The hind wing is faintly amber-tinted to a considerable depth along the grey or blackish apical or terminal margins. In the fore wing the lighter portions of the longitudinal nervures are rather paler than in the ♂, and the great cross-vein is paler than the cross-veinlets; the caudal setæ are lighter in colour. Length of setæ ♂ im. 25–35, ♀ im. 25 mm.

Hab. North Carolina (M'Lach. Mus.). For comparison with the tabulation of proportional lengths of tarsal joints of representatives of other genera given above at p. 236, the corresponding admeasurements of the tarsi of adult specimens of this species are here subjoined:—

	Fore tarsus.					Intermediate tarsus.					Hind tarsus.				
	I.	II.	III.	IV.	V.	I.	II.	III.	IV.	V.	I.	II.	III.	IV.	V.
♂....	10	20	24	16	8	5	7	7	4	7	5	6	6	3	6
♀....	6	11	12	6	11	5	8	8	5	9	5	7	7	4	9

In the fore leg of the ♂ the tarsus is about $1\frac{5}{8}$ as long as the tibia; in the ♀ the fore tarsus is about $\frac{5}{8}$ as long as the tibia.

P. 268, l. 10 from top, *for* Subz. *read* Sulz.

P. 270, lines 15 to 3 from bottom, *note* To *H. cærulans* belongs all that relates to *H. gallica*, given below at pp. 272–273. I have lately examined specimens of *H. cærulans* in Mr. Albarda's collection named by Herr Rostock, and can now vouch for the identity of *H. gallica* with *cærulans*.

P. 272, l. 5 from top, *for* GALLICA, sp. nov., *read* [*gallica*, Etn. MS.=] CÆRULANS, Rostock.

P. 272, l. 7 from top, after "*Heptagenia*" read *cærulans*, ! Rostock, Jahresb. d. Ver. f. Naturk. Zwickau, 1877, p. 89 (1878).—*Heptagenia*.

P. 273, lines 14 from top, *after* "*Hab.*" *insert* Weisseritz, near Dretschen, Saxony (Rostock).

P. 273, lines 16–18 from top, *omit* all references relating to *H. volitans*.

P. 274, *dele* lines 22–24 from top, and lines 1–4 from bottom. Note *H. volitans* is an *Ecdyurus* described at p. 291.

P. 306, l. 6 from bottom, *for* Prof. *read* M.

P. 307, l. 18 from top, *for* Retourna *read* Retourner.

P. 307, l. 11 from bottom, *for* 2; (?) sp., *read* ; (?) 2 sp.

P. 309, l. 5 from bottom, *for* (3) *read* (8).

P. 315, l. 20, for *Coloburus*, read *Coloburiscus*.

DESCRIPTION OF THE PLATES.

The figures in Plates I.–XXIV. (with two acknowledged exceptions) are mainly photo-lithographs of drawings made with the camera lucida from the specimens by the Author. Being designed to illustrate the genera, a distinctive numeral is appropriated to each genus; and, when necessary, a special letter is affixed to the generical numeral, to indicate what species are concerned in the illustrations appertaining to that genus. Numerals written smaller than the generical numerals are used to designate particular legs and wing-nervures. The fore leg, intermediate leg and hind leg are numbered respectively 1, 2, and 3. The wing-nervures are numbered in accordance with the plan set forth in page 4 of this volume:—1, the Costa, 2, the Subcosta, 3, the Radius, 4, the Sector, 4′, the hindermost of the adventitious branches of the Sector, 5, the Cubitus, 6 and 6′, the Præbrachial and its hindermost branch, 7 and 7′, the Pobrachial and its hindermost branch, 8, the Anal, 9^1, 9^2, and 9^3, Axillary nervures. The natural lengths of the wings are shown by hair-lines.

Plates XXV.–LXII. and part of LXIII. (with a single acknowledged exception) are from drawings by Hollick, from the specimens, executed under the Author's supervision. The figures in each of these Plates are numbered consecutively, and certain letters are uniformly used to designate particular parts of the insects, viz.:—*a*, the antenna, *lbr*, the labrum, *r. md*, the right mandible, *l. md*, the left mandible, mx^1, the first maxilla, mx^2, the second maxilla, *lbm*, the labium, *t*, the tongue, l^1, the fore leg, l^2, the intermediate leg, l^3, the hind leg, *tb*, tracheal branchiæ [those of the abdomen numbered pair by pair successively from the foremost], *c. s.* caudal setæ. In some of these Plates detached views of certain regions of the body are uniformly lettered as follows:—A, dorsal view of the insect, B, ventral view of the same, C, side view of the head, D, head from beneath, E, head from above, F, front view of head. The natural lengths of the insects are shown by hair-lines, and to the figure of each detail is annexed an indication in numerals of the scale of enlargement.

Plates LXIV., LXV. and part of LXIII. are from drawings by the Author from the specimens, lithographed by Hollick. They are essentially supplementary to earlier plates.

N.B.—The wings of dried specimens, in some of the genera, are apt to be completely shrivelled up (*e.g.* those figured in Plate III.). When such is the case, recurse may be had to the following method of preparing them for examination. The wing detached from the specimen is first of all floated upon scalding water, and induced to expand as fully as possible whilst it is floating. It is next taken up upon paper or a strip of glass and transferred to cold water, and then spread out to dry upon paper or glass. If upon paper, the wing can presently be separated therefrom by bending the paper away from it, and it can either be mounted permanently as an object for the microscope, or be placed temporarily for examination within a compress-cell, care being taken to flatten it out by only vertical and gentle pressure. If the result be then unsatisfactory, the whole process can be repeated.

Plate I.

Neuration, limbs, external ♂ genitalia, and ♂ head of 1. *Palingenia* (adult):—all enlarged.

Figs. 1 *a*. *P. longicauda*:—wings, legs (1–3) of ♂, fore leg of ♀ with a larger view of the fore tarsus and a much larger one of the ungues, a penis-lobe and forceps-limb (underside view), [the two dots on the 4th joint of the limb are due to a flaw in the stone], vertical view of the ♂ head, and side view of the same.

Fig. 1 *b*. *P. lata*:—fore wing.

Fig. 1 *c*. *P. ampla*:—fore wing.

Fig. 1 *d*. *P. javanica*:—underside view of ♂ genitalia.

Plate II.

Neuration, limbs, external ♂ genitalia, and parts of caudal setæ of 1. *Palingenia* (adult) and 9. *Jolia* (reputed adult) :—all enlarged.

Figs. 1 *d*. *P. javanica* :—part of fore wing, legs (1–3) of ♂, with a larger view of the ungues of the fore tarsus, and two portions of a caudal seta, taken respectively from before the middle and towards the tip of the same, both highly magnified.

Figs. 1 *e*. *P. tenera* :—fore wing and two portions of a caudal seta corresponding with the above.

Figs. 1 *f*. *P. papuana* :—part of fore wing, and underside view of genitalia.

Figs. 9. *J. Rœseli* :—parts of both wings, legs (1–3) of ♂, with enlarged views of the terminal joint of the fore tarsus, and likewise of the intermediate and the hind tarsi, and underside view of a forceps-limb and penis.

Plate III.

Neuration, limbs, external ♂ genitalia of 2. *Oligoneuria*, 3. *Elassoneuria*, 4. *Spaniophlebia*, 5. *Lachlania*, 6. *Homœoneuria*, and head of adult ♂ *Oligoneuria* :—all enlarged.

Figs. 2 *a*. *O. rhenana* :—wings of ♂ and of ♀, legs (1–3) of ♂, much enlarged; underside view of part of the extremity of ♂ abdomen, showing a 3-jointed forceps-limb, the penis, and (in stippled outline) the retracted stimuli; another underside view of the penis with sperm-ducts partly extruded and the stimuli retracted; extremity of a forceps-limb 4-jointed instead of 3-jointed; head of adult ♂ viewed from above; the same from in front; the same from the side.

Figs. 2 *b*. *O. anomala* :—wings, legs (1 and 3) of ♂ much enlarged and (1–3) of ♀; side view of genitalia (dried) with separate figures of a forceps-limb, and of the penis-lobes subtended by the forceps-basis, or a laminar lobe of the 9th ventral segment.

Fig. 3. *E. Trimeniana* :—wings of ♀.

Figs. 4. *S. Traili*æ :—wings, legs (1–3) of ♂, and underside view of genitalia.

Figs. 5. *L. abnormis* :—wings of ♀. *L. lucida* :—partial underside view of genitalia.

Fig. 6. *H. Salviniæ* :—wings of ♀.

Plate IV.

Neuration, limbs, and ♂ forceps of 7. *Euthyplocia* :—all enlarged.

Fig. 7 *a*. *E. Hecuba* :—wings of ♀.

Fig. 7 *b*. Another species :—hind wing of ♀.

Figs. 7 *c*. *E. anceps* :—defective wings, legs (1–3), with enlarged views of the intermediate and posterior tarsi; dorsal view of the extremity of the abdomen and forceps-limbs (setæ omitted),—all of the ♂ and dried.

Fig. 7 *d*. Another species :—underside view of forceps.

Plate V.

Neuration, limbs, external ♂ genitalia, and head of adult ♂ of 8. *Campsurus* :—all enlarged.

Figs. 8 *a*. *C. albifilum* :—fore wing, fore leg of the adult ♂; fore leg of ♂ subimago; underside view of ♂ genitalia, showing the penis-lobes in faint outline; vertical view of the head and part of the thorax.

Fig. 8 *b*. Another species :—hind wing of ♀.

Figs. 8 *c*. *C. latipennis* :—wings; a partial underside view of ♂ genitalia, showing on the right, at the base of the figure, part of a filiform forceps-limb, with an unciform prickle adjacent thereto, also a bifidly excised subgenital plate, the penis-lobes slightly opened out but incurved, and either stimuli or sperm-ducts protruded with divergent points; another partial underside view of the

same from a different specimen, showing a forceps-limb, both of the spinules or prickles adjacent to the forceps-limb, one half of the subgenital plate, and the penis-lobes closed together (dried).

Fig. 8 *d*. *C. cuspidatus* :—underside view of ♂ genitalia (dried).

Fig. 8 *e*. *C. quadridentatus* :—underside view of subgenital plate with the right forceps-limb entire ; penis-lobes viewed from behind, points upwards ; side view of a penis-lobe, point downwards, much more enlarged (dried).

Figs. 8 *f*. *C. curtus* :—partial underside view of ♂ genitalia, showing the right forceps-limb and the base of the left limb, and also the penis-lobes above the halves of the subgenital plate distorted in drying. Also two detached figures, much more enlarged, of penis-lobes (dried).

Plate VI.

Neuration of 8², a nameless insect related to *Campsurus*. Also neuration, limbs, external ♂ genitalia, and head of adult ♂ of 10. *Polymitarcys* :—all enlarged.

Fig. 8 bis. Nameless Brazilian insect (M'Lach. Mus.) :—wings.

Figs. 10 *a*. *P. virgo* :—wings ; legs (1–3) of adult ♂, with enlarged views of the intermediate and posterior tarsi ; fore leg of ♂ subimago, on the same scale of enlargement as the adult fore leg ; ventral view of ♂ genitalia, showing the penis and a forceps-limb ; vertical view of the adult ♂ head with part of the pronotum.

Fig. 10 *b*. A S.-African species :—fore wing.

Fig. 10 *c*. A N.W.-Indian species :—hind wing.

Plate VII.

Neuration, limbs, and external ♂ genitalia of 11. *Hexagenia* ; all enlarged.

Fig. 11 *a*. A N.W.-Indian species :—fore wing and part of hind wing.

Figs. 11 *b*, 11 *b'* and 11 *b*?. *H. bilineata* :—hind wing and part of a fore wing ; three views of single forceps-limbs, each with another view, on rather a larger scale, of the extremity of the limb, illustrating variations in the number and relative size of the smaller joints [of these three, the two on the right side of the plate are from dried specimens ; the underside view of the ♂ genitalia, on the left side of the plate, is from an alcoholic specimen, and shows the penis-lobes—one shaded, the other in outline].

Figs. 11 *c*. *H. limbata* :—wings ; legs (1–3) of each sex ; ♂ genitalia, showing a forceps-limb and a penis-lobe (dried). The remarkable aberration displayed in the neuration of the fore wing here figured is described at the bottom of p. 4.

Plate VIII.

Neuration, limbs, and external ♂ genitalia of 12. *Ephemera* and 13. *Pentagenia* ; also head of adult ♂ *Ephemera*.

Figs. 12 *a*. *E. danica* :—wings ; legs (1–3) of ♂ and (1) of ♀, with an enlarged view of the terminal joint and ungues of the ♂ fore tarsus ; forceps viewed from below.

Figs. 12 *b*. *E. vulgata* :—part of a fore wing ; underside view of penis-lobes.

Figs. 12 *c*. *E. supposita* :—underside view of ♂ genitalia, showing forceps and penis ; a slightly enlarged side view of a penis-lobe (dried).

Figs. 12 *d*. *E. glaucops* ; head of adult ♂, the upper figure being taken from in front of the specimen, and the lower from the side. The latter view includes part of the prothorax and of the fore leg.

Figs. 13. *P. vittigera* :—wings of both sexes ; legs (1–3) of both sexes ; underside view of penis and a forceps-limb (dried).

Plate IX.

Neuration, limbs, external ♂ genitalia of 14. *Potamanthus* and 15. *Rhoënanthus* and head of adult ♂ *Potamanthus*:—all enlarged.

Figs. 14. *P. luteus*:—wings; legs (1–3) of ♂ and fore leg of ♀; two underside views of forceps, one in outline (dried) and the other shaded (freshly killed); two underside views of the penis, the uppermost fresh, and the lower dried; a vertical view of the adult ♂ head, and a side view of the same with part of the thorax and of the fore leg.

Figs. 15. *Rh. speciosus*:—both wings and part of a fore wing; underside view of forceps (dried); underside view of the penis (dried).

Plate X.

Neuration, limbs, external ♂ genitalia, and adult ♂ head of 16. *Atalophlebia*:—all enlarged.

Figs. 16*a*. *A. annulata*:—wings; legs (1–3) of ♂ with a more enlarged view of the hind tarsus; forceps (dried); underside view of penis (dried).

Fig. 16*b*. *A. taprobanes*:—oblique side view of penis (dried).

Figs. 16*c*. *A. australasica*:—two fore wings and a hind wing; underside view of penis (dried).

Fig. 16*d*. *A. strigata*:—hind wing and part of a fore wing; fore leg of adult ♀.

Figs. 16*e*. *A. nodularis*:—fore wing; hind wing more enlarged; a side view and an underside view of penis [rather inferior to the older figures of the same] (dried).

Figs. 16*f*. *A. scita*:—forceps and underside view of penis (dried).

Figs. 16*g*. *A. chilensis*:—hind wing; legs (1–3) of ♂; a forceps-limb and two views of the penis (dried).

Figs. 16*h*. *A. tabularis*:—hind tarsus, intermediate tarsus, and the terminal joint of the fore tarsus of the adult ♂; underside view of the forceps-basis, and a forceps-limb; underside view of penis; vertical view of adult ♂ head; side view of the same, showing the ascalaphoid form of oculi (from a specimen preserved in spirits and glycerine).

Figs. 16*i*. A nameless species:—wings, and a more enlarged view of the hind wing.

Plate XI.

Neuration and limbs of 17. *Leptophlebia* and 18. *Blasturus*, and external ♂ genitalia of *Leptophlebia*:—all enlarged.

Figs. 17*a*. *L. marginata*:—wings; legs (1–3) of ♂ and fore leg of ♀, with a more enlarged view of the intermediate ♂ tarsus; underside view of the forceps-basis and the right forceps-limb, illustrating the occasional 4-jointed condition of the limb; underside view of penis (freshly killed).

Figs. 17*b*. *L. mollis*:—wings; side view of forceps (dried).

Figs. 17*c*. *L. præpedita*:—(*uppermost figure*) side view of penis, subtended by an erect underside view of the same; (*right and left figures at the bottom of the group*) underside view of forceps, and side view of the same (dried).

Fig. 17*d*. *L. Meyeri*:—underside view of penis (dried).

Figs. 18. *B. concinnus* [=*cupidus*]:—wings and legs.

Plate XII.

Neuration, limbs, and external ♂ genitalia of 19. *Choroterpes*, and 20. *Thraulus*:—all enlarged.

Figs. 19. *Ch. Picteti*:—wings, with a more enlarged view of the hind wing; legs (1–3) of ♂, with more enlarged views of the intermediate and hind tarsi, and one, on much larger scale, of the extremity of the fore tarsus; underside view of forceps, and of penis (from specimens in fluid).

Figs. 20. *Th. bellus* :—wings, with part of a fore wing, and a more enlarged view of the hind wing; legs (1–3) of ♂, with more enlarged views of the intermediate and hind tarsi; underside view of forceps, and of penis (from specimens in fluid).

Plate XIII.

Neuration, limbs, and external ♂ genitalia of 20*. *Thraulus* (provisional) [including 23*. *Calliarcys* (provisional)], 21. *Adenophlebia*, and 22. *Habrophlebia*.—[For 23. *Caliarcys* (proper) see Plate XIV.]

Figs. 20*[2]. *Th. exiguus* :—wings, with a more enlarged view of the hind wing; one of the hinder tarsi; underside partial view of ♂ genitalia, with another more enlarged view of the penis (dried).

Fig. 20*[3]. *Th. colombiæ* :—hind wing, much enlarged.

Figs. 21. *A. dislocans* :—wings; legs (1–3) of ♂, with a more enlarged view of the intermediate tarsus; a forceps-limb and an underside view of the penis (dried).

Figs. 22 *a*. *H. fusca* :—wings; legs (1–3) of ♂, with more enlarged views of the hinder tarsi; underside view of the forceps, and of the penis (freshly killed).

Figs. 22 *b*. *H. modesta* :—side view and underside view of penis (dried).

[Figs. 23*[2], 23*[3], and 23*[1], referred provisionally to *Calliarcys* in the writing on the Plate, are cited in the descriptive letterpress at pp. 109–110 under *Thraulus*.]

Figs. 23*[2]. A nameless insect :—wings, with a more enlarged view of the hind wing.

Figs. 23*[3]. *Th. lætus* :—part of a fore wing; one of the hinder tarsi; partial underside view of the penis and a forceps-limb (dried).

Figs. 23*[1]. *Th. mexicanus* :—hind wing, much enlarged; underside view of the penis and a forceps-limb (dried).

Plate XIV.

Neuration, limbs, and external ♂ genitalia of 23. *Calliarcys*, and 24. *Ephemerella*; also adult ♂ head of the latter :—all enlarged.

Figs. 23. *C. humilis* :—wings, with portions of two fore wings, illustrating differences in the intercalary nervures of the anal-axillar interspace, and a more enlarged view of the hind wing; legs (1–3) of ♂ and the fore leg of ♀, with more enlarged views of the ♀ fore tarsus and the hinder ♂ tarsi; underside view of forceps and penis (from a specimen in fluid).

Figs. 24 *a*. *E. ignita* :—legs (1–3) of ♂ and fore leg of ♀; underside view of forceps and penis; head of ♂ viewed from above, from the side, and from in front (freshly killed).

Figs. 24 *b*. *E. grandis*, a N.-American species :—wings, with part of a fore wing showing an unusual arrangement of the neuration, the longest of the adventitious nervures (7′) included between the pobrachial (7) and the anal (8) nervures, meeting this last instead of the pobrachial nervure; a more enlarged view of the hind wing.

Fig. 24 *c*. *E. invaria* :—underside view of penis (dried).

Plate XV.

Neuration of 21 bis. *Hagenulus*, 24 bis. *Teloganodes*, 25. *Tricorythus*, 25 bis. *Leptohyphes*, 26. *Cænis*, and (after Vayssière) 27. *Prosopistoma*, with limbs and genitalia of *Hagenulus* and *Cænis*, and head of adult ♂ of this last.

Figs. 21bis. *H. caligatus* :—wings, with a more enlarged view of the hind wing; legs (1–3) of ♀ and fore leg of ♂, with more enlarged views of the ♂ fore tarsus and ♀ hind tarsus; penis with a slightly enlarged view of one of its divisions in a different posture; one of the forceps-limbs (dried). [This ♂ im. should be ranked with the 4 ♀ imagines mentioned at p. 114, line 13 from top.]

Figs. 24 bis. *Tel. tristis* :—wings, with a more enlarged view of the hind wing.

Fig. 25. Wing of a nameless Malay species of *Tricorythus*, received from Mr. Ritsema. [The ciliation of the wing is rather too dense.]

Fig. 25 bis. *L. eximius* :—wing.

Figs. 26 *a*. *C. halterata* :—legs (1–3) of ♀ and fore legs of ♂, with a more enlarged view of the ♀ hind tarsus; underside view of genitalia; vertical view of adult ♂ head, shaded, with the pronotum in outline, showing the very great disproportion in size between the anterior ocellus [visible in front], and the hinder ocelli [protuberant above the orbits of the eyes] (freshly killed).

Figs. 26 *b*. *C. dimidiata* :—wing; underside view of genitalia (freshly killed).

Figs. 27. *P. punctifrons* [*foliaceum*] :—wings of the reputed adult (preserved in fluid) after Vayssière, but not facsimile.

Plate XVI.

Neuration and ♂ forceps of 28. *Callibætis* and 29. *Baëtis*; also femoral markings of some species of the former genus, and head of adult ♂ *Baëtis* :—all enlarged.

Figs. 28 *a*. *C. Hageni* :—fore wing and a more enlarged view of the hind wing; part of a femur.

Figs. 28 *b*. *C. ferrugineus* :—fore wing, and a more enlarged view of the hind wing of ♀ im.

Figs. 28 *c*. *C. pictus* :—wings, with a more enlarged view of the hind wing; two femora.

Figs. 28 *d*. *C. montanus* :—wings, with a more enlarged view of the hind wing; a femur.

Figs. 29 *a*. *B. Salvini* :—wings, with a more enlarged view of the hind wing: underside view of forceps (dried).

Figs. 29 *b*. *B. binoculatus* :—wings, with a more enlarged view of the hind wing; underside view of forceps (freshly killed).

Figs. 29 *c*. *B. rhodani* :—hind wing, much enlarged; head of ♂ viewed obliquely from above in front, and the same viewed from the side, showing the form of the composite oculi, and the inequality of the ocelli, described at p. 153 (freshly killed).

Fig. 29 *d*. *B. vernus* :—underside view of forceps (freshly killed).

Fig. 29 *e*. *B. pumilus* :—hind wing, much enlarged (freshly killed).

Fig. 29 *f*. *B. niger* :—underside view of forceps (freshly killed).

Plate XVII.

Limbs of 28. *Callibætis*, 29. *Baëtis*, 30. *Centroptilum*, and 31. *Cloëon*; wings and forceps of *Centroptilum* and *Cloëon*, and adult ♂ head of the former: all enlarged.

Figs. 28. *C. ferrugineus* :—legs (1–3) of ♂, fore leg of ♀ (dried).

Figs. 29. *B. rhodani* :—legs (1–3) of ♂ and fore leg of ♀, with the hinder tarsi of the ♀ on a corresponding scale of enlargement.

Figs. 30 *a*. *C. luteolum* :—wings, with a more enlarged view of the hind wing; underside view of the forceps; head of adult ♂ from in front, and also from the side, showing the composite form of the oculi and the disparity in size between the foremost and the hinder ocelli, described at p. 153 (freshly killed).

Figs. 30 *b*. *C. pennulatum* :—hind wing, much enlarged; legs (1–3) of ♂; underside view of forceps; side view of ♂ head (freshly killed).

Fig. 30 *c*. *C. tenellum* :—underside view of forceps (preserved in fluid).

Figs. 31 *a*. *C. dipterum* :—fore leg and hinder tarsi of ♀; underside view of forceps (freshly killed).

Figs. 31 *b*. *C. simile* :—wing; legs (1–3) of ♂; underside view of forceps (freshly killed).

Fig. 31 *c*. *C. rufulum* :—underside view of forceps (freshly killed).

Fig. 31 *d*. *C. bimaculatum* :—wing [in the pterostigmatic region, the front of the wing (through accident on the part of the author) is slightly displaced].

Plate XVIII.

Neuration, limbs, and external ♂ genitalia of 32. *Coloburus* [=*Coloburiscus*]; also external ♂ genitalia of 33. *Chirotonetes*, and limbs of 34. "*Siphlurus?*" [=*Ameletus*]:—all enlarged.

Figs. 32 *a*. *C. humeralis*:—wings; legs (1–3) of ♂ and fore leg of ♀; partial underside view of forceps; underside of penis (dried).

Figs. 32 *b*. A nameless N.-American *Coloburiscus*:—hind wings and part of a fore wing; legs (1–3) of ♀ (dried).

Fig. 32 *c*. *C. haleuticus*:—underside view of penis (dried).

Fig. 33 *d*. *Ch. siccus*: underside view of the forceps-basis, with parts of the limbs, with parts of the penis-lobes in outline (dried).

Figs. 33 *e*. *Ch. aridus*:—underside view of the forceps-basis, with parts of the limbs and a portion of the 9th segment; also (above the number) underside view of the extremity of the penis in outline, with dried exudation coarsely stippled (dried).

Figs. ?34 *a'*. "*S. ?femoratus*" [=*A. subnotatus*]:—legs (1–3) of ♂ and fore leg of ♀ (dried).

Plate XIX.

Neuration, limbs, external ♂ genitalia, and ♂ head of 33. *Chirotonetes*, and a wing of 32. *Coloburiscus*:—all enlarged.

Fig. 32. *C.* "*halenticus*" [for *haleuticus*]:—fore wing.

Figs. 33 *a*. *Ch. mancus*:—wings only [the legs are wrongly lettered].

Figs. 33 *b*. *Ch. ignotus*:—both wings and part of a fore wing; legs [wrongly lettered 33 *a* for 33 *b*] (1–3) of ♂ and fore leg of ♀; underside partial view of genitalia held aslant, showing a forceps-limb and part of the forceps-basis with one and a portion of the other of the penis-lobes (dried); vertical, front, and side views of adult ♂ head (freshly killed).

Figs. 33 ? *c*. *Ch.* ? *ornatus* (page 208):—underside view of forceps and of penis (dried).

Plate XX.

Neuration and limbs of 34. *Siphlurus*, ?34. *Metamonius*, and 35. *Dipteromimus*, with external ♂ genitalia of the first and the last genus and head of adult ♂ *Siphlurus*:—all enlarged.

Figs. ?34 *b*. *S.* [*Metamonius*] *anceps*:—wings and legs (1–3) of ♂ (dried).

Figs. 34 *c*. *S. typicus*:—wings.

Figs. 34 *d*. *S. lacustris*:—legs (1–3) of ♂ and fore leg of ♀; underside of forceps; vertical and side views of adult ♂ head (freshly killed).

Fig. 34 *e*. *S. armatus*:—underside view of forceps and part of segment 9 (dried).

Figs. 35. *D. tipuliformis*:—fore wing and part of the hind wing; legs (1–2) of ♂, with a more enlarged view of the intermediate tarsus; side view and underside view of genitalia, showing the forceps and the penis (dried). A complete figure of the hind wing is shown in Pl. LXIV.

Plate XXI.

Neuration, limbs, and external ♂ genitalia of 36. *Oniscigaster* and 37. *Bætisca*, with head of adult ♂ of the former:—all enlarged.

Figs. 36. *O. Wakefieldi*:—wings; legs (1–3) of ♀ and fore leg of ♂: underside view of the genitalia, with the 9th and part of the 8th segment, showing the right and part of the left forceps-limb, and the shrunken penis; head viewed obliquely from in front and also from the side (dried).

Figs. 37. *B. obesa*:—wings; legs (1–3) of ♀ and fore leg of ♂; underside view of the right forceps-limb and the penis (dried).

Plate XXII.

Neuration, limbs, and external ♂ genitalia of 38. *Ametropus*, 39. *Atopopus*, and 40. *Thalerosphyrus* :—all enlarged.

Figs. 38. *Am. fragilis* :—fore wing and most of the hind wing; fore leg of ♀ adult, and of ♂ adult and subimago, with a more enlarged view of ♂ intermediate leg; underside view of forceps, with a part of the left limb omitted; underside view of penis placed in juxtaposition with the preceding figure (dried).

Figs. 39. *At. tarsalis* :—wings; legs (1–3) of ♂; underside view of forceps and penis (dried).

Figs. 40. *Th. determinatus* :—wings, slightly defective; intermediate leg and hind leg of ♂; underside view of genitalia, showing the forceps-basis, the left forceps-limb, and the penis (dried).

Plate XXIII.

Neuration of the *Ecdyurus* type, exhibiting differences, for the most part fortuitous, in the connections established between the adventitious nervures and the main nervures of wings, *which are of no generic significance*. The fore wings were selected chiefly for the purpose of demonstrating diverse common combinations of the adventitious or intercalar nervures of the anal-axillar interspace (defined at page 81); but fig. 43 has reference to those of the sectorial group, and (like fig. 42) shows how a spurious "apical fork" may be originated. The figures are all enlarged.

Figs. 41. *Pægniodes cupulatus* :—hind wing and part of a fore wing.

Fig. 42. *Compsoneuria spectabilis* :—wings. It may be doubted whether the remarkable paucity of cross-veinlets in the fore wing is a constant generic characteristic.

Fig. 43. *Rhithrogena semicolorata* :—part of a fore wing, showing an occasional combination of sectorial intercalary nervures.

Figs. 44. "*Epeorus*" [= *Iron*] *longimanus* :—wings and parts of fore wings of three different specimens.

Fig. 45. *Heptagenia gallica* :—fore wing.

Fig. 46. *Ecdyurus venosus* :—hind wing, showing a denser condition of the adventitious neuration of the terminal border than obtains in the other wings figured. This is not of generic import.

Plate XXIV.

Limbs and genitalia of 41. *Pægniodes*, 42. *Compsoneuria*, 43. *Rhithrogena*, 44. *Iron*, 44 a. *Epeorus*, 45. *Heptagenia*, and 46. *Ecdyurus* :—all enlarged.—N.B. Pages 234–236 of the letterpress should be consulted on account of the possibility of some of the legs and tarsi represented in this Plate being deformed.

Figs. 41. *P. cupulatus* :—legs (1–3) of ♀ [the intermediate is defective]; underside view of penis and the left forceps-limb (dried).

Figs. 42. *C. spectabilis* :—fore and hind leg of ♀; underside partial view of genitalia (dried).

Figs. 43. *Rh. semicolorata* :—legs (1–3) of ♂ and fore leg of ♀, with more enlarged views of the corresponding tarsi; underside views of penis (43^1 and 43^2) freshly killed and (43^3) dried.

Fig. 43 *a*. *Rh.* "*semitincta*" [= *alpestris*] :—underside view of penis (freshly killed).

Fig. 43 *b*. *Rh. germanica* :—underside view of penis (dried).

Fig. 43 *c*. *Rh. Hageni* :—underside view of penis (dried).

Fig. 43 *d*. *Rh. aurantiaca* :—fore tarsus of ♀ (alcoholic).

Figs. 44. *I. longimanus* :—legs (1–3) of ♂ and fore leg of ♀, with more enlarged views of the corresponding tarsi (dried).

Figs. 44 a. *Ep. torrentium* :—legs (1–3) of ♂ and fore leg of ♀, with more enlarged views of the corresponding tarsi; underside view of penis (freshly killed).

Figs. 45. *H. sulphurea* :—legs (1–3) of ♂ and fore leg of ♀, with more enlarged views of the corresponding tarsi; underside view of penis (freshly killed).

Figs. 45 *a*. *H. gallica* :—fore tarsus and intermediate tarsus of ♀; underside view of penis (dried).

Figs. 46. *Ec. venosus* :—legs (1–3) of ♂ and fore leg of ♀, with more enlarged views of the corresponding tarsi; underside view of penis, with the lobes held somewhat apart (freshly killed).

Fig. 46 *a*. *Ec. helveticus* :—fore tarsus of ♂ (dried) for comparison with the corresponding figure of the same tarsus of *Ec. venosus*.

Fig. 46 *b*. *Ec. "quæsitor"* [=*venosus*, var.] :—underside view of penis (freshly killed) with the lobes rather close together.

Fig. 46 *c*. *Ec. italicus* :—underside view of penis (freshly killed) with the lobes closed together.

Fig. 46 *d*. *Ec. insignis* :—corresponding view of penis (freshly killed) suffused with seminal fluid.

Plate XXV.

Figs. 1–19. *Palingenia* (*Anagenesia*), sp.—Nymph. Figures all enlarged.—1. Dorsal view of insect about $\frac{3}{4}$rds grown. 2. Ventral view of the thorax and abdomen of the same. 3. Side view of the head and prothorax, × 11 diam. 4. Underside view of head, × 11 diam. 5. Antennæ and frons, × 13 diam. 6. Antenna, × 45 diam. 7. Labrum, upper surface. 8. Left mandible, viewed from below, × 25 diam. 9. The same, viewed from above, × 25 diam. 10. Right 1st maxilla and palpus, × 25 diam. 11. Right 2nd maxilla and palpus, × 20 diam. 12. Dorsal view of the tongue and its lateral lobes or paraglossæ, × 25 diam. 13. Left fore leg, viewed from behind. 14. Front view of the same. 15. Tarsal claw of the same, more enlarged. 16. Intermediate leg. 17. Hind leg. 18. Right tracheal branchia of the 1st pair, or of the 2nd abdominal segment, spread out to show the arrangement of the fringes, × 10 diam. 19. Right tracheal branchia of the 2nd pair, × 13 diam. (From Ceylon, in alcohol.)

Figs. 20–24. *Palingenia*, sp.—Nymph. Figures all enlarged. 20. Dorsal view of the insect in an advanced stage of growth, with the head and prothorax slightly dislocated. 21. Ventral view of the head and body of the same. 22 and 23. Right tracheal branchia of the 3rd pair or 4th abdominal segment, with the divisions spread to show the fringes in 22, and closed together in 23, × 13 diam. 24. Dorsal view of two of the caudal setæ, × 12 diam. (From Brazil, in alcohol.)

Plate XXVI.

Oligoneuria rhenana. Nymph.

Figs. 1–20 all enlarged.—1. Dorsal view of insect, nearly approaching the last moult, in the attitude of repose. 2. Ventral view of the head and body of a rather younger, but also nearly adult specimen, × 3·5 diam. 3. Side view of the head, showing the tuft of fibrils of the tracheal branchia annexed to the 1st maxilla, × 8 diam. 4. Vertical view of the head of the same ♀, of advanced age (A). 5. Vertical view of the thorax and a few of the anterior segments of the abdomen of the younger specimen B, showing the hood formed by membrane uniting the terminal margins of the fore wings. 6. Diagrammatic side view of the thorax and anterior abdominal segments of specimen A, showing the position and relative sizes of the 1st and 2nd abdominal tracheal branchiæ. 7. Antenna, × 30 diam. 8. Labrum, × 30 diam. 9 and 10. Left and right mandibles, × 30 diam. 11. Left 1st maxilla and palpus, with the annexed fascicle of branchial fibrils, × 30 diam. 12. The same, reversed, without the fibrils. 13. Interior view of labium, lower maxillæ, and palpi, × 15 diam. 14. Tongue and paraglossæ, from above, × 30 diam.

15. Fore leg, 16. Intermediate leg, and 17. Hind leg, all × 8 diam. 18. Ventral view of the right tracheal branchia of the foremost abdominal pair, with the lamina placed edgewise, so as to display the fibrils, × 30 diam. 19. Vertical view of the right tracheal branchia of the 2nd abdominal pair, with the lamina slightly depressed, so as to show the place of its insertion, × 30 diam. 20. Right and median caudal setæ, × 8 diam. (From France, in fluid.)

Plate XXVII.

Jolia Rœselii. Nymph.

Figs. 1–24, all enlarged.—1. Dorsal view of insect shortly before the last moult, in the posture of repose [the legs not quite in perspective]. 2. Ventral view of headless body of the same, showing (*t. b.*) fibrillose tracheal branchiæ in the region of the neck beside the prosternum. 3. Side view of head and part of the thorax, with fore leg and antenna cut off, × 12 diam. 4. Underside view of the same, showing (*t. b.*) branchial fibrils as before, × 12 diam. 5. Antenna, × 20 diam. 6. Exterior view of labrum, × 20 diam. 7 and 8. Right and left mandibles, × 40 diam. 9. Left 1st maxilla and palpus, with a tuft of (*t. b.*) branchial fibrils, and part of a tendon annexed to the stipes, × 40 diam. 10. Underside, and 11. Upperside views of the labium, 2nd maxillæ, and palpi, × 20 diam. 12. Tongue and paraglossæ from above, × 20 diam. 13. Fore leg, and 14. Interior view of the tibial armature, × 12 diam. 15. Intermediate, and 16. Hind legs, × 12 diam. 17–23. Right tracheal branchiæ of the seven abdominal pairs numbered successively from the foremost, all × 30 diam. 24. Left tracheal branchia of the third abdominal pair, × 40 diam. (From Toulouse, in fluid.)

Plate XXVIII.

Polymitarcys virgo. Nymph.

Figs. 1–21, all enlarged.—1. Dorsal view of ♀ insect in the attitude of repose, shortly before the last moult. 2. Ventral view of the headless body of another specimen. 3. Side view of ♀ head and part of prothorax, × 8 diam. [The "× 30" belongs to fig. 15.] 4. Underside view and 5. Vertical view of the same, × 8 diam. 6. Antenna, × 20 diam. 7. Labrum × 35 diam. 8. Underside of right mandible, × 20 diam.; some of the longer hairs were partially erased to make room for fig. 15. 9. Upperside of the same, × 20 diam. 10. Part of the left mandible, and 11. corresponding part of the right mandible, placed for the display of the fangs and the molar surfaces, × 30 diam. 12. First maxilla and palpus, × 30 diam. 13. Labium, 2nd maxillæ, and palpi viewed from above [the laciniæ of the maxillæ out of focus], × 30 diam. 14. Side view of right 2nd maxilla and palpus, × 30 diam. 15. Dorsal view of tongue and paraglossæ, × 30 diam. 16. Left fore leg, × 12 diam. 17. The same, reversed. 18. Intermediate leg, and 19. Hind leg, × 12 diam. 20. Tracheal branchia of the 1st abdominal pair, × 30 diam. 21. One of the sixth pair, spread out for display of the fringes, × 30 diam.—This Plate underwent considerable alterations at a late period before publication. Most of the figures were drawn from Toulouse specimens; but after these were lithographed, better examples were obtained from Brive.

Plate XXIX.

Figs. 1–5. *Hexagenia*, sp.—Nymph. All enlarged.—1. Dorsal view of insect about half-grown. 2. Ventral view of head and body of the same. 3. Outside of a tracheal branchia of the 3rd abdominal pair, × 13 diam. 4. The same, reversed; the divisions of the lamina in both the figures are spread out a little to display the fringes. 5. Right outer and median caudal setæ, × 12 diam. (From Mus. Comp. Zool. Cambridge, Mass., in alcohol.) For other details of the nymph of *Hexagenia* see Pl. LXIII.

Figs. 6–17. *Euthyplocia*, sp.—Nymph-skin. All enlarged.—6. Dorsal view of the slough of the insect, shed perhaps at the last nymphal moult; scalded and posed in the attitude of *Ephemera*, Pl. XXX. 7. Underside of head of the same, × 4 diam. 8. Antenna and part of the right mandible, × 7 diam. 9. Exterior of labrum, × 20 diam. 10. Right mandible, from beneath, × 17 diam. [The lacinia is doubtless out of shape in this as well as in the other figure.] 11. Corresponding view of part of left mandible, × 17 diam. 12. First maxilla and palpus, × 25 diam. 13. Underside of labium, 2nd maxillæ, and palpi, × 15 diam. 14. Dorsal view of tongue and paraglossæ, × 25 diam. 15. Fore leg, × 4 diam. 16. Intermediate leg, and 17. Hind leg, × 4 diam. After the figures were drawn, the skin was dried and re-carded (Mus. Roy. de Bruxelles). Pictet's figures of nymphs of this genus (cited in the text) are inaccurate in several particulars.

Plate XXX.

Ephemera vulgata. Nymph.

Figs. 1–19, all enlarged.—1. Dorsal view of ♀ insect of advanced grade in an attitude of repose. 2. Ventral view of the headless body of another specimen. 3. Side view (partly diagrammatic) of the fore part of the body and head, with legs and antenna cut off, showing the arrangement of the first three abdominal tracheal branchiæ, and one of the two conical projections in front of the head in profile, × 7 diam. 4. Underside of head, with antennæ cut off, showing the mandibles closed, and the tusks interlocked at their tips, × 7 diam. 5. Antenna, × 15 diam. 6. Exterior of labrum, × 25 diam. 7. Right mandible, viewed with the fangs pointing upwards, × 25 diam. 8. Left mandible, viewed with the fangs in profile, × 25 diam. 9. Part of the right mandible with the fangs in profile, × 25 diam. 10. Exterior of left mandible, × 25 diam. 11. First maxilla and palpus, × 25 diam. 12. Labium and 2nd maxillæ, with parts of palpi, viewed from above, × 25 diam. 13. Exterior of the same, with palpi. 14. Dorsum of tongue and paraglossæ, × 25 diam. 15. Fore leg, 16. Intermediate leg, and 17. Hind leg, all × 10 diam. 18. Tracheal branchia of the 1st abdominal pair, × 30 diam. 19. One of the 4th abdominal pair, spread to display the fringes, × 15 diam. (In fluid.)

Plate XXXI.

Potamanthus luteus. Nymph.

Figs. 1–16, all enlarged.—1. Dorsal view of ♀ insect of advanced grade, in a posture of repose. 2. Ventral view of the head and body of the same. 3. Side view of the head and part of the prothorax. 4. Underside of head. 5. Antenna, × 25 diam. 6. Exterior of labrum, × 35 diam. 7. Right mandible, with tendon attached, × 35 diam. 8. Left mandible, with tendon, × 35 diam. 9. First maxilla and palpus, × 35 diam. 10. Exterior of labium, 2nd maxillæ, and palpi, × 35 diam. 11. The same, reversed. 12. Dorsal view of tongue and paraglossæ, × 35 diam. 13. Fore leg, 14. Intermediate leg, 15. Hind leg, all × 12 diam. 16. Tracheal branchia of the 3rd abdominal pair. (From Brive, in fluid.)

Plate XXXII.

Leptophlebia cincta [fig. 2, *L. submarginata*]. Nymph.

Figs. 1–13, all enlarged.—1. Dorsal view of insect about ½ grown, at rest, but with the legs disposed somewhat conventionally. 2. Ventral view of the head and body of a specimen approaching the last moult. 3. Antenna, × 70 diam. 4. Exterior of labrum, × 70 diam. 5. Right mandible, with tendon attached, × 100 diam. 6. Left mandible, with tendon, × 100 diam. 7. First

maxilla and palpus, with torn muscular tissue attached to the stipes, × 70 diam. 8. Labium, 2nd maxillæ, and palpi, × 50 diam. 9. Dorsal view of tongue and paraglossæ, × 50 diam. 10. Fore leg, 11. Intermediate leg, 12. Hind leg, each × 50 diam. 13. Tracheal branchia of the 3rd abdominal pair, × 50 diam. (In fluid.)

Plate XXXIII.

Blasturus, sp.—Nymph.

Figs. 1–19, all enlarged.—1. Dorsal view of insect with defective setæ, of advanced grade, in a conventional attitude. 2. Ventral view of head and body of the same. 3. Antenna, × 25 diam. 4. Exterior of labrum, × 30 diam. 5. Right mandible, × 45 diam. 6. Left mandible, × 45 diam. 7. First maxilla and palpus, × 45 diam. 8. Underside of labium, 2nd maxillæ, and palpi, × 40 diam. 9. Dorsal view of tongue and paraglossæ, × 40 diam. 10. Fore leg, 11. Intermediate leg, 12. Hind leg, each × 13 diam. 13–19. Tracheal branchiæ of the abdomen (one of every pair) numbered successively from the foremost, all × 15 diam. (In alcohol.)

Plate XXXIV.

Choroterpes Picteti. Nymph.

Figs. 1–20, all enlarged.—1. Dorsal view of insect of advanced grade. 2. Ventral view of head and body of the same. 3. Antennæ, × 25 diam. 4. Exterior of labrum, × 20 diam. 5. Right mandible, with tendon attached, × 30 diam. 6. Left ditto. 7. First maxilla and palpus, × 20 diam. 8. Point of the lacinia of the same maxilla reversed, × 60 diam. 9. Underside of labium, 2nd maxillæ, and palpi, × 20 diam. 10. Dorsal view of tongue and paraglossæ, × 20 diam. 11. Fore leg, 12. Intermediate leg, 13. Hind leg, all × 20 diam. 14–20. Tracheal branchiæ of the abdomen (one of every pair) numbered consecutively from the foremost, all × 20 diam. (In fluid, from Portugal.)

Plate XXXV.

Thraulus bellus. Nymph.

Figs. 1–22, all enlarged.—1. Dorsal view of insect of very advanced grade, with the legs in a conventional pose, but otherwise in a quiescent posture. 2. Ventral view of the head and body of the same. 3. Antennæ, × 30 diam. 4. Exterior of labrum, × 30 diam. 5. Right mandible, with tendon attached, × 60 diam. 6. Left ditto. 7. First maxilla and palpus, × 30 diam. 8. Point of the lacinia of the same maxilla reversed, × 60 diam. 9. One of the pectinate spinules or bristles of the preceding, more enlarged. 10. Underside view of labium, 2nd maxillæ, and palpi, × 30 diam. 11. Dorsal view of tongue and paraglossæ, × 30 diam. 12. Fore leg, 13. Intermediate leg, 14. Hind leg, all × 20 diam. 15–21. Tracheal branchiæ of the abdomen (one of every pair) numbered consecutively from the foremost, all × 20 diam. 22. The foremost of these × 45 diam. (From Cintra, in fluid.)

Plate XXXVI.

Habrophlebia fusca. Nymph.

Figs. 1–24, all enlarged.—1. Dorsal view of insect of advanced grade in repose. 2. Ventral view of head and body of another specimen. 3. Antenna, × 25 diam 4. Exterior of labrum, × 50 diam. 5 and 6. Right and left mandibles with tendon attached, × 65 diam. 7. First

maxilla and palpus, × 65 diam. 8. Part of the lacinia of the same maxilla reversed, × 65 diam. 9. One of the pectinate spinules at the extreme point of the same, more enlarged. 10. Underside of hypopharynx, labium, 2nd maxillæ, and palpi, × 65 diam. 11. Part of the same reversed, × 65 diam. 12. Dorsal view of tongue and paraglossæ [no record of enlargement]. 13–15. Fore, intermediate, and hind legs numbered consecutively, × 20 diam. 16–22. Tracheal branchiæ of the abdomen (the right one of every pair) numbered consecutively from the foremost, all × 20 diam. 23. The foremost of the same, × 35 diam. 24. The outer and median caudal setæ, × 20 diam. (In fluid.)

Plate XXXVII.

Ephemerella ignita. Nymph.

Figs. 1–20, all enlarged.—1. Dorsal view of ♀ insect, with legs in a conventional posture; a light-coloured specimen captured in the Holybrook above Reading, Berks, similar to that figured by Pictet, *op. cit.* pl. xxix. 1, and of very advanced grade. 2. Ventral view of a dark ♂ specimen captured in a trout-stream, similar to that figured by Pictet, *op. cit.* pl. xxxiii. 1, and of very advanced grade. 3. Head of ♂, from in front. 4. Antenna, × 50 diam. 5. Exterior of labrum, × 50 diam. 6 and 7. Right and left mandibles, with tendon attached, × 80 diam. 8. First maxilla and palpus, × 80 diam. 9. Underside view of labium, 2nd maxillæ, and palpi, × 85 diam. 10. Dorsal view of tongue and paraglossæ, × 50 diam. 11–13. Legs numbered consecutively, × 40 diam. 14–18. Tracheal branchiæ of the abdomen (the left one of every pair) numbered consecutively from the foremost, × 45 diam. 19. The third of the same reversed to display the lamelligerous appendage, × 70 diam. 20. Outer and median caudal setæ of ♂, × 25 diam. (In fluid.) This Plate underwent considerable revision upon the stone before publication.

Plate XXXVIII.

Figs. 1–10. Nymph No. I., allied to *Ephemerella*, described at p. 131. Figures all enlarged.—1. Dorsal view of insect of advanced grade, with the legs disposed conventionally. 2. Ventral view of head and body of the same. 3. Front view of head, × 12 diam. 4. First maxilla and palpus, × 70 diam. 5. The same reversed. 6–8. Legs of the left side numbered in succession, × 15 diam. 9. Spinules of the lower edge of the fore femur, × 60 diam. 10. A hair from the upper edge of the hind femur, × 95 diam. (In alcohol.)

Figs. 11–15. Nymph No. II. (p. 131). Figures all enlarged.—11. Dorsal view of insect of advanced grade, in repose. 12. Ventral view of head and body of the same. 13. Side view of the same. 14. Front view of head. 15. First maxilla and palpus, × 40 diam. (In alcohol.)

Plate XXXIX.

Nymph No. III., allied to *Ephemerella*, described at p. 132.

Figs. 1–22, all enlarged.—1. Dorsal view of insect of very advanced grade. 2. Dorsal view of the headless body of a younger specimen, with the tracheal branchiæ removed from the right side of the abdomen and depressed on the left side of the same. 3. Ventral view of head and body of the same. 4. Front view of head, × 12 diam. 5. Antenna, × 30 diam. 6. Exterior of labrum, × 40 diam. 7. Right mandible, × 65 diam. 8. Left mandible, with part of the stipes omitted, × 65 diam. 9. Molar surface of the same, × 170 diam. 10. First maxilla and palpus, × 65 diam. 11. Underside of labium, 2nd maxillæ, and palpi, × 40 diam.

12. Upperside of labium and 2nd maxillæ, × 40 diam. 13. Dorsal view of tongue and paraglossæ, × 40 diam. 14–16. Legs numbered in succession, × 13 diam. 17–22. Tracheal branchiæ of the right side of the abdomen, one of every pair, together with a second figure of the third of them; figures 17, 18, and 20–22 represent the complete series numbered consecutively from the foremost; figure 19 is the reverse of the third in the series. (In alcohol.)

Plate XL.

Figs. 1–17. Nymph No. IV., allied to *Ephemerella*, described at p. 133. Figures all enlarged.—1. Dorsal view of a nymph-skin out of which the subimago had emerged. 2. Ventral view of head and body of the same. 3. Vertical view of head, × 10 diam. 4. Exterior of labrum, × 25 diam. 5 and 6. Right and left mandibles, × 40 diam. 7. First maxilla and palpus, × 40 diam. 8. Underside of labium, 2nd maxillæ, and palpi, × 40 diam. 9. Dorsal view of tongue and paraglossæ, × 40 diam. 10–12. Legs, numbered successively from the foremost, × 12 diam. 13–16. Tracheal branchiæ of the abdomen, one of every pair, numbered consecutively from the foremost, × 25 diam. 17. The third of them reversed, × 25 diam. (In alcohol.)

Figs. 18–20. Nymph No. V., allied to *Ephemerella*, described at p. 133 [Supplemented by Pl. LXIV. figs. 3–8]. Figures all enlarged.—18. Dorsal view of insect of advanced grade. 19. Ventral view of head and body of the same. 20. Tracheal branchia of the 3rd abdominal pair, reversed. (In alcohol.)

Plate XLI.

Reputed Nymph of *Tricorythus*.

Figs. 1–20, all enlarged.—1. Dorsal view of insect of very advanced grade. 2. Ventral view of head and body of the same. 3. Antenna, × 35 diam. 4. Exterior of labrum, × 35 diam. 5. Right mandible with tendon attached, × 65 diam. 6. Left ditto, × 65 diam. 7. First maxilla and palpus, × 65 diam. 8. Tongue and paraglossæ, × 35 diam. 9–11. Legs numbered consecutively from the foremost, × 20 diam. 12. Foremost right abdominal tracheal branchia [after Vayssière]. 13–17. Left tracheal branchiæ of the remaining pairs numbered consecutively, × 30 diam. 18. Left tracheal branchia of the 2nd abdominal pair reversed, showing the marginal flange along the inner border, × 30 diam. 19. Part of the exterior of the right tracheal branchia of the same pair, showing the row of hairs along the inner border which hitch under the flange of the opposite one, × 30 diam. 20. Outer and part of the median caudal setæ, × 15 diam. 21. Underside of labium, 2nd maxillæ, and palpi, × 65 diam. (In alcohol, from Dr. E. Joly; captured at Toulouse.)

Plate XLII.

Cænis halterata, figs. 1, 2, 7–17, and 22–25; a species from Portugal figs. 3, 4; and *C. luctuosa*, = *Harrisella*, figs. 5, 6, 18–21, and 27–28. Nymphs. Figures all enlarged.—1. Dorsal view of insect of advanced grade, at rest, but with the intermediate legs disposed somewhat conventionally. 2. Vertical view of head, showing the large rounded hinder ocelli prominent above the oculi, × 30 diam. 3. Dorsal view of insect of very advanced grade, and of another species, remarkable for the dilated lateral borders of the notum. 4. Ventral view of head and body of the same. 5. Vertical view of head of *C. Harrisella*, remarkable for the conical tubercles upon the sites of the ocelli, × 20 diam. 6. Antenna, × 50 diam. 7. Exterior of labrum, × 65 diam. 8. Right mandible with tendon, × 100 diam. 9. Left ditto. 10. Part of right mandible of another specimen placed to display the fangs, × 50 diam. 11. The same

placed to display the molar surface, × 50 diam. 12. First maxilla and palpus, × 100 diam. 13. Underside of labium, 2nd maxillæ, and palpi, × 100 diam. 14. Dorsal view of tongue and paraglossæ, × 50 diam. 15–17. Legs numbered successively from in front, × 35 diam. 18–20. Legs of *C. Harrisella* correspondingly numbered, × 20 diam. 21. Foremost right tracheal branchia of the abdomen of the same, × 30 diam. 22–26. Left tracheal branchiæ of the remaining abdominal pairs of *C. halterata* numbered consecutively from the foremost (the first of them, fig. 22, reversed), × 35 diam. 27. Exterior of the right tracheal branchia of the 2nd abdominal pair of *C. Harrisella*, × 30 diam. 28. Caudal setæ of the same, × 20 diam. [The terminal segment in this figure appears to be of questionable form.] (The named nymphs were English specimens preserved in the glycerine water-and-spirits solution; the Portuguese nymph was in an alcoholic solution.)

Plate XLIII.

Prosopistoma foliaceum. Nymph.

Figs. 1–12, all enlarged.—1. Dorsal view of ♀ insect at rest, with setæ partially retracted. 2. Ventral view of the same, with the right legs cut off and the left legs slightly displaced to show the depressions in which the femora are laid. 3. Antenna, × 100 diam. 4. Labrum and clypeus, × 45 diam. 5. Right mandible, furnished with an unusually long endopodite, × 90 diam. 6. First maxilla and palpus, × 90 diam. 7. Underside of labium and mentum, × 25 diam. 8. Underside of labium and 2nd maxillary palpi, × 65 diam. 9. Fore leg, × 40 diam. 10. Spinules of fore tibia, × 210 diam. 11. Intermediate leg, × 40 diam. 12. Hind leg, × 40 diam. (From Dr. E. Joly, captured at Toulouse; in alcohol.)

Plate XLIV.

Baëtis rhodani. Nymph.

Figs. 1–20, all enlarged.—1. Dorsal view of ♀ insect of very advanced grade in repose (the legs not quite in perspective). 2. Side view of head of the same. 3. Oblique under front view of the same, × 35 diam. 4. Antenna, × 35 diam. 5. Exterior of labrum, × 35 diam. 6. First maxilla and palpus, × 70 diam. 7. Right mandible and tendon, × 70 diam. 8. Left ditto. 9. Underside of labium, 2nd maxillæ, and palpi, × 35 diam. 10. Dorsal view of tongue and paraglossæ, × 35 diam. 11–13. Legs numbered consecutively from the foremost, × 25 diam. 14–20. Right tracheal branchiæ of every abdominal pair numbered consecutively from the foremost, × 35 diam. (In alcohol.)

Plate XLV.

Nymph allied to *Centroptilum*, from Peru.

Figs. 1–19, all enlarged.—1. Dorsal view of insect of advanced grade. 2. Ventral view of the same. 3. Part of antenna, × 40 diam. 4. Labrum, × 50 diam. 5. Right mandible and tendon, × 75 diam. 6. Left ditto. 7. First maxilla and palpus, × 50 diam. 8. Underside of labium, 2nd maxillæ, and palpi, × 40 diam. 9. Dorsal view of tongue and paraglossæ, × 50 diam. 10–12. Left legs numbered consecutively, × 25 diam. 13–18. Right tracheal branchiæ, one of every abdominal pair, numbered consecutively from the foremost, × 40 diam. (In alcohol.)

Plate XLVI.

Centroptilum luteolum. Nymph.

Figs. 1–19, all enlarged.—1. Dorsal view of insect of advanced grade, in repose. 2. Ventral view of head and body of the same. 3. Antenna, × 25 diam. 4. Exterior of labrum, × 65 diam. 5. Right mandible with tendon attached, × 100 diam. 6. Left ditto. 7. First maxilla and palpus, × 100 diam. [The palpus is only 3-jointed. The artist has mistaken the prop upon which the palpus is inserted for a 4th joint, and focussed the underlying edge of the stipes. Compare the corresponding figures in Pls. XLVII. & L.] 8. Underside of labium, 2nd maxillæ, and palpi, × 65 diam. 9. Dorsal view of tongue and paraglossæ, × 65 diam. 10–12. Legs numbered consecutively from the foremost, × 30 diam. 13–19. Tracheal branchiæ of the abdomen, one of every pair, numbered consecutively from the foremost, × 60 diam. (In fluid.)

Plate XLVII.

Cloëon rufulum, figs. 1 & 4, c. *simile*, figs. 2, 3, 5–21, and c. *dipterum*, fig. 22. Nymphs. Figures all enlarged.—1. Dorsal view of ♀ insect of advanced grade, in repose [the legs not in perspective]. 2. Side view of prothorax and head, with the fore leg and antenna cut off, × 25 diam. 3. Front view of head, × 25 diam. 4. Antenna, × 18 diam. [The antennæ of the other species are much shorter and have fewer joints.] 5. Exterior of labrum, × 35 diam. 6. Right mandible, × 70 diam. 7. Left ditto with part of the stipes omitted. 8. Lacinia and palpus of the right 1st maxilla, × 70 diam. 9. Left 1st maxilla and palpus, × 70 diam. 10. Underside view of labium, 2nd maxillæ. and palpi, × 35 diam. 11. Dorsal view of tongue and paraglossæ, × 35 diam. 12–14. Legs numbered successively from the foremost, × 18 diam. 15–21. Right tracheal branchiæ of the abdomen reversed, one of every pair, × 25 diam. 22. Right and median caudal setæ, × 10 diam. [The tail-points of most of the species are short like these.] (In fluid.)

Plate XLVIII.

Callibætis, sp. Nymph.

Figs. 1–19, all enlarged.—1. Dorsal view of ♀ insect of very advanced grade. 2. Ventral view of head and body of the same. 3. Antenna, × 23 diam. 4. Exterior of labrum, × 45 diam. 5. Right mandible with tendon attached, × 65 diam. 6. Left mandible, × 65 diam. 7. First maxilla and palpus, × 65 diam. 8. Underside of labium, 2nd maxillæ, and palpi, × 35 diam. 9. Dorsal view of tongue and paraglossæ [enlargement unrecorded]. 10–12. Legs numbered successively from the foremost, × 20 diam. 13–19. Right tracheal branchiæ (in reverse) of the abdomen, one of every pair, numbered consecutively from the foremost, × 30 diam. (In alcohol, from Dr. Hagen.)

Plate XLIX.

? *Chirotonetes*, sp. Nymph.

Figs. 1–19, all enlarged.—1. Dorsal view of insect of very advanced grade, in a conventional posture. 2. Ventral view of head and body of the same. 3. Antenna, × 30 diam. 4. Labrum, × 30 diam. 5. Right mandible, with tendon attached and muscular tissue within the hollow of the stipes, × 50 diam. 6. Left ditto. 7. First maxilla and palpus, × 50 diam. 8. Underside of labium, 2nd maxillæ, and palpi, × 50 diam. 9. Dorsal view of tongue and paraglossæ, × 30 diam. 10–12. Legs numbered successively from the foremost, × 15 diam. 13–19. Right tracheal branchiæ (in reverse) of the abdomen, one of every pair, × 50 diam. (In alcohol, from Dr. Hagen.)

Plate L.

Siphlurus lacustris, figs. 1, 4–6, & 9–19; and a nameless Portuguese species, figs. 2, 3, 7, 8, & 20–26. Nymphs. Figures all enlarged.—1. Dorsal view of ♂ insect of very advanced grade at rest, with tracheal branchiæ spread; the legs not in perspective. 2. The same view of a ♀ of rather younger grade of another species, with the tracheal branchiæ depressed. 3. Ventral view of head and body of the same. 4. Side view of head and part of thorax, × 8 diam. 5. Antenna, × 30 diam. 6. Exterior of labrum, × 35 diam. 7. Right mandible with tendon attached, × 35 diam. 8. Left mandible, × 35 diam. 9. The same, with the tendon, placed to display the fangs, × 30 diam. 10. First maxilla and palpus, × 45 diam. [The joining above the prop of the palpus is distended with fluid accidentally.] 11. Underside or exterior view of labium, 2nd maxillæ, and palpi. 12. Partial view of the same reversed. 13. Dorsal view of tongue and paraglossæ, × 35 diam. 14–16. Legs numbered successively from the foremost, × 16 diam. 17–19. Right tracheal branchiæ of the 1st, 3rd, and 7th abdominal pairs of *S. lacustris*, × 25 diam. 20–26. Right tracheal branchiæ of the abdomen, one of every pair, of the other species, × 15 diam. (*S. lacustris* in fluid; the other species in alcohol.)

Plate LI.

Oniscigaster Wakefieldi. Nymph.

Figs. 1–23, all enlarged.—1. Dorsal view of ♂ insect about $\frac{2}{3}$ grown, placed in a conventional attitude. 2. Ventral view of head and body of the same. 3. Side view of head and part of thorax, × 8 diam. 4. Front view of the head from above, × 8 diam. 5. The same from below, × 8 diam. 6. Antenna, × 30 diam. 7. Exterior of labrum, × 30 diam. 8. Right mandible with tendon attached, × 30 diam. 9. Left ditto. 10. First maxilla and palpus, × 30 diam. 11. Underside of labium, 2nd maxillæ, and palpi, × 30 diam. 12. Dorsal view of tongue and paraglossæ, × 30 diam. 13–15. Legs numbered successively from the foremost, × 11 diam. 16–21. Right tracheal branchiæ of the abdomen, one of every pair, numbered consecutively from the foremost, × 11 diam., in outline. 22 & 23. Finished drawings of the 1st and 2nd of the same, × 20 diam., with the adjoining pleura. (In alcohol.)

Plate LII.

Bætisca obesa. Last slough cast by ♂ nymph.

Figs. 1–14, all enlarged.—1. Dorsal view of slough. [The antennæ were originally represented in this figure; but as they are out of sight when the insect is alive, they were erased in the proving, and only a very faint indication of the left antenna was allowed to remain.] 2. Ventral view of head and body of the same. 3. Side view of head and part of thorax, with the antenna partly removed. 4. Antenna, × 75 diam. 5. Exterior of labrum, × 35 diam. 6. Right mandible with part of tendon, × 60 diam. 7. Left ditto. 8. First maxilla and palpus, with membrane attached to the stipes, × 60 diam. 9. Underside of labium, 2nd maxillæ and palpi, mentum, and hypopharynx, × 35 diam. 10. Dorsal view of tongue and paraglossæ, × 35 diam. 11–13. Right legs numbered successively from the foremost, × 19 diam. 14. Underside of the right and median caudal setæ, with part of the extremity of the abdomen, × 25 diam. (Slough scalded.)

Plate LIII.

Last slough cast by the nymph of a nameless insect, described at pp. 229–230.

Figs. 1–14, all enlarged.—1. Dorsal view of slough, defective in the setæ and in the five hinder pairs of abdominal tracheal branchiæ. 2. Antenna, × 35 diam. 3. Exterior of labrum [attached to the frons, with antennæ partly removed], × 10 diam. 4 & 5. Left mandible in two positions, × 20 diam. 6. First maxilla and palpus, with a portion of the tongue (paraglossa) adhering, × 12 diam. 7. The same palpus, × 65 diam. 8. Underside of labium, 2nd maxillæ, palpi, &c., × 12 diam. 9. One of the same palpi, × 25 diam. 10–12. Legs numbered successively from the foremost, × 10 diam. 13. One of the tracheal branchiæ of the foremost abdominal pair, × 12 diam. 14. Right tracheal branchia of the 2nd abdominal pair, in reverse, × 12 diam. (Slough dried; scalded.)

Plate LIV.

Rhithrogena aurantiaca and [figs. 3 & 4] *Rh. semicolorata*. Nymphs.

Figs. 1–24, all enlarged.—1 Dorsal view of insect of very advanced grade, in repose, with tracheal branchiæ spread. 2. Ventral view of head and body of the same. 3. Dorsal view of another, with the laminæ of the tracheal branchiæ deflected. 4. Side view of the same. 5. Face, upside down, with antennæ partly removed, × 12 diam. 6. Antenna, × 35 diam. 7. Labrum, × 35 diam. 8. Right mandible, × 60 diam. 9. Left ditto, × 60 diam. [Point of mandible more enlarged, Pl. LXV. 6.] 10. First maxilla and palpus, × 35 diam. 11. Underside of labium, 2nd maxillæ, and palpi, × 35 diam. 12. Ditto, reversed. 13. Dorsal view of tongue and paraglossæ, × 35 diam. 14–16. Left legs, numbered successively from the foremost, × 15 diam. 17–23. Tracheal branchiæ of the abdomen, one of every pair, numbered consecutively from the foremost, × 25 diam. 24. Left and median caudal setæ, × 15 diam. (*Rh. aurantiaca*, in fluid, from Tarascon, Ariège; *Rh. semicolorata*, in alcohol, from Dorset.)

Plate LV.

Iron, sp. Nymph.

Figs. 1–19, all enlarged.—1. Dorsal view of insect of very advanced grade. 2. Ventral view of head and body of the same. 3. Face with antennæ partly removed. 4. Antenna, × 30 diam. 5. Exterior of labrum, × 80 diam. 6. Right mandible, × 50 diam. 7. Left ditto. 8. First maxilla and palpus, × 65 diam. 9. Underside or exterior of labium, 2nd maxillæ, and palpi, × 30 diam. 10–12. Right legs [with the hairs of the tibiæ accidentally thrown backwards, and those of the tarsi out of sight] numbered successively from in front, × 15 diam. 13–19. Tracheal branchiæ of the abdomen, one of every pair, numbered consecutively from the foremost, × 30 diam. [In alcohol, from Dr. Hagen.]

Plate LVI.

Epeorus torrentium. Nymph.

Figs. 1–22, all enlarged.—1. Dorsal view of ♀ insect of very advanced grade, in repose. 2. Ventral view of head and body of the same. 3. Face, × 9 diam. 4. Antenna, × 30 diam. 5. Exterior of labrum, × 30 diam. 6. Right mandible, × 50 diam. 7. Left, ditto. 8. First maxilla and palpus, × 30 diam. 9. Underside or exterior of labium, 2nd maxillæ, and palpi, × 25 diam. 10. Upperside or interior of ditto. 11. Tongue and paraglossæ, × 30 diam. 12–14. Left legs, numbered successively from the foremost, × 10 diam. 15–21. Tracheal branchiæ of the abdomen, one of every pair, numbered consecutively from in front, × 20 diam. 22. One caudal seta and part of the other, × 12 diam. [In alcohol, from Tarascon, Ariège.]

Plate LVII.

Nymph No. I., allied to *Ecdyurus*, described at p. 262.

Figs. 1–21, all enlarged.—1. Dorsal view of insect of very advanced grade. 2. Ventral view of head and body of the same. 3. Face, × 12 diam. 4. Part of antenna, × 40 diam. 5. Labrum, × 35 diam. 6. Right mandible, × 60 diam. 7. Left ditto. 8. First maxilla and palpus, × 40 diam. 9. Underside or exterior of labium, 2nd maxillæ, and palpi, × 20 diam. 10. Dorsal view of tongue and paraglossæ, × 35 diam. 11–13. Right legs, numbered successively from the foremost. 14–20. Tracheal branchiæ of the abdomen, one of every pair, numbered consecutively from the foremost, the 2nd reversed to display the arrangements of the fibrils, × 35 diam. 21. Median and part of the left caudal setæ, × 12 diam. (In alcohol.)

Plate LVIII.

Nymph No. II., allied to *Ecdyurus*, described at p. 263.

Figs. 1–21, all enlarged.—1. Dorsal view of insect of advanced grade. 2. Ventral view of head and body of the same. 3. Face, × 12 diam. 4. Antenna, × 40 diam. 5. Interior surface of labrum, × 20 diam. 6. Part of the right mandible, × 35 diam. 7. Left mandible, × 35 diam. 8. First maxilla and palpus, × 35 diam. 9. Underside of labium, 2nd maxillæ, and palpi, × 15 diam. 10. Dorsal view of tongue and paraglossæ, × 15 diam. 11. Right fore leg, × 20 diam. 12 & 13. Left legs of the other pairs, numbered successively, × 20 diam. 14–20. Tracheal branchiæ of the abdomen, one of every pair, numbered consecutively from in front, × 30 diam. 21. The 3rd of them reversed to display the explanate webbed fibrils, × 40 diam. (In alcohol.)

Plate LIX.

Nymph No. III., allied to *Ecdyurus*, described at p. 264.

Figs. 1–19, all enlarged.—1. Dorsal view of ♀ insect of very advanced grade, lacking setæ. 2. Ventral view of head and body of the same. 3. Part of antenna, × 50 diam. 4. Inner side of labrum, × 50 diam. 5. Right mandible, × 70 diam. 6. Left ditto. 7. First maxilla and palpus, × 70 diam. 8. Underside or exterior of labium, 2nd maxillæ, and palpi, × 25 diam. 9. Dorsal view of tongue and paraglossæ, × 50 diam. 10–12. Right legs of every pair, numbered successively from the foremost. 13–19. Tracheal branchiæ of the abdomen, one of every pair, numbered consecutively from in front, × 50 diam. (In alcohol.)

Plate LX.

Heptagenia [*cærulans*] *gallica*. Nymph.

Figs. 1–23, all enlarged.—1. Dorsal view of ♀ insect of very advanced grade, at rest. 2. Ventral view of thorax and abdomen of another ♀ specimen. 3. Face. 4. Underside of head. 5. Antenna, × 35 diam. 6. Exterior of labrum, × 25 diam. 7. Right mandible, × 40 diam. 8. Left ditto. 9. First maxilla and palpus, × 40 diam. 10. Underside of labium, 2nd maxillæ, and palpi, × 25 diam. 11. Dorsal view of tongue and paraglossæ, × 30 diam. 12. Left fore leg, × 12 diam. 13 & 14. Right legs of the other pairs, numbered successively from the foremost, × 12 diam. 15–21. Tracheal branchiæ of the abdomen, one of every pair, numbered consecutively from in front, × 30 diam. 22. The 1st of them reversed, to display the fibrils × 30 diam. 23. Right and median caudal setæ, × 12 diam. (In alcohol, from Toulouse.)

Plate LXI.

Nymph of junior grade, perhaps of an *Ecdyurus* allied to *E. venosus*, but possibly of one related more nearly to *E. lateralis*: see p. 277.

Figs. 1–17, all enlarged.—1. Dorsal view of insect about $\frac{2}{3}$ grown. 2. Ventral view of head and body of the same. 3. Part of antenna, × 30 diam. 4. Labrum, × 35 diam. 5. Right mandible, × 70 diam. 6. Left ditto. 7. First maxilla and palpus, × 35 diam. 8. Underside of labium, 2nd maxillæ, and palpi, × 17 diam. 9. Dorsal view of tongue and paraglossæ, × 30 diam. 10. Right intermediate leg, × 13 diam. 11–17. Tracheal branchiæ of the abdomen, one of every pair, numbered consecutively from in front, × 35 diam. (In alcohol.)

Plate LXII.

Ecdyurus fluminum [— *angustipennis*, figs. 1 & 4–23], *E. venosus* [figs. 2 & 3], and another [perhaps a junior grade of *E. venosus*, or perhaps of *E. lateralis*, figs. 24 & 25]. Nymphs.

Figs. 1–25, all enlarged.—1. Dorsal view of insect of moderately advanced grade. 2. Ventral view of head and body of another of very advanced grade. 3. Face of the same. 4. Antenna, × 30 diam. 5. Labrum, × 20 diam. 6. Right mandible, × 50 diam. 7. Part of the left ditto. 8. First maxilla and palpus, × 20 diam. 9. Point of the lacinia of the same, × 170 diam. 10. Underside of labium, 2nd maxillæ, and palpi, × 20 diam. 11. The same reversed, × 20 diam. 12. Dorsal view of tongue and paraglossæ, × 20 diam. 13–15. Right legs, one of each pair, numbered successively from the foremost, × 10 diam. [In the original drawings the markings were not shown in any of these figures, the specimens being faded; but subsequently the markings of a newly killed specimen of *E. venosus* were introduced into fig. 13.] 16–22. Tracheal branchiæ of the abdomen, one of every pair, numbered consecutively from in front, × 20 diam. 23. Median and right caudal setæ, × 7 diam. 24. Dorsal view of insect of junior grade. 25. Right tracheal branchiæ of the 3rd pair of the same, × 40 diam. (*E. fluminum* in fluid; the others in alcohol.)

Plate LXIII.

Figs. 1–13. *Hexagenia*, sp. Nymph. Supplementary to Pl. XXIX. Figures all enlarged.—1. Antenna, × 20 diam. 2. Exterior of labrum, × 25 diam. 3. Right mandible, × 20 diam. 4. Left ditto. 5. First maxilla and palpus, × 25 diam. 6. Underside of labium, 2nd maxillæ, and palpi, × 25 diam. 7. The same reversed [showing only the bases of the palpi]. 8. Dorsal view of tongue and paraglossæ, × 20 diam. 9. Right fore leg, × 9 diam. 10. Ditto in reverse. 11 & 12. The other right legs, numbered consecutively, × 9 diam. 13. Tracheal branchiæ of the 1st abdominal pair, × 25 diam. (In alcohol.)

Figs. 14–17. *Ephemera*; forceps of adult ♂ of four species. Supplementary to Pl. VIII. Figures all enlarged.—14. *E. compar* (dried). 15. *E. guttulata* (dried). 16. *E. simulans*, with the penis-lobes (in alcohol). 17. *E. varia*, with the penis-lobes (dried).

Plate LXIV.

Supplementary to earlier Plates. Figures 3–8 drawn by A. T. Hollick; the other figures by the Author. All enlarged.

Figs. 1, 1 *a*. *Atalophlebia fasciata* [Supplemental to Pl. X.].—1. Penis of adult ♂ in profile; 1 *a*. Ditto, supine.

Figs. 2, 2 *a*. *Habrophlebia fusca* [Suppl. to Pl. XIII. 22 *a*].—2. Fore leg of adult ♀. 2 *a*. Tarsus of ditto, more enlarged.

Figs. 3–8. Abdominal tracheal branchiæ of a nameless N.-American nymph, allied to *Ephemerella* [Suppl. to Pl. XL. 18–20].—3–7. One of every pair, numbered consecutively from the foremost, viewed prone. 8. One of the 2nd pair, supine. All enlarged 30 diam.

Figs. 9–20. Genitalia of adult ♂ *Baëtis* [Suppl. to Pl. XVI. 29].—9. *B. scambus*, forceps-limb. 10. *B. rennstulus*, ditto. 11. Penis of the same. 12. *B. rhodani*, forceps-limb. 13. *B. Bocagii*, ditto. 14. *B. gemellus*, ditto. 15. *B. Atrebatinus*, ditto. 16. *B. tenax*, ditto. 17. *B. melanonyx*, ditto. 18. *B. alpinus*, ditto. 19. *B. buceratus*, ditto. 20. *B. pumilus*, ditto.

Fig. 21. *Centroptilum luteolum*, fore leg of ♀ adult [Suppl. to Pl. XVII. 30].

Figs. 22–24. *Ameletus*, tarsus and forceps-basis [Suppl. to Pl. XVIII. ? 34].—22. *A. dissitus*, forceps-basis. 22 *a*. Hind tarsus. 23. *A. subnotatus*, forceps-basis. 24. *A. exquisitus*, ditto.

Fig. 25. *Dipteromimus tipuliformis*, hind wing [Suppl. to and corrective of Pl. XX. 35].

Fig. 26. *Siphlurus occidentalis*, forceps-basis [Suppl. to Pl. XX. 34].

Plate LXV.

Supplementary to earlier Plates. Figures of details, all enlarged, drawn by the Author.

Fig. 1. *Bleptus fasciatus*:—limbs, hinder tarsi, and hind wing of adult ♂ [Suppl. to Pl. XXIV.].

Figs. 2 & 3. *Iron*:—ventral views of adult ♂ genitalia, dried [Suppl. to Pl. XXIV. 44].—2. *I. longimanus*. 3. *I. nitidus*.

Figs. 4 & 5. *Cinygma*:—ventral views of adult ♂ genitalia, dried [Suppl. to Pl. XXIV.].—4. *C. integrum*. 5. *C. par*.

Fig. 6. *Rhithrogena aurantiaca*, nymph [Suppl. to Pl. LIV. 8]. Fangs of the right mandible, viewed from above, under pressure, enlarged 173 diameters.

Fig. 7. *Epeorus psi*:—ventral view of adult ♂ genitalia, in alcohol [Suppl. to Pl. XXIV. 44 A].

Fig. 8. [Suppl. to Pls. XII. & XIII.].—Hind wing of a nameless N.-American insect in Mus. Comp. Zool., Cambridge, Mass., ticketed No. 78, Kentucky, 7. iii. 1882.

Fig. 9. *Ephemerella notata*:—ventral view of adult ♂ genitalia (living) [Suppl. to Pl. XIV.].

Figs. 10 & 11. *Baëtis*:—hind wings [Suppl. to Pl. XVI.].—10. *B. consuetus*. 11. *B. solidus*. Enlarged 106 diameters.

Fig. 12. *Centroptilum Pocyi*:—hind wing [Suppl. to Pl. XVII. 30]. Enlarged 137 diameters.

Fig. 13. *Ameletus inopinatus*:—ventral view of adult ♂ forceps, dried [Suppl. to Pls. XVIII. ? 34 and LXIV. 22–24].

Additions and Corrections (continued from p. 325).

P. 282, l. 18 from bottom, for *venosus* read *venosa*.

P. 302, l. 12 from top, before *fuscus* insert ||.

P. 315, l. 20, for *Coloburus* [preoccupied in Entomology] read *Coloburiscus*.

P. 320, before l. 7 from bottom *insert*:—P. 142, *after* l. 19 from top *read*

Synonymy. *Brachycercus*, Curtis (1834), applicable only to ♀ and subimago specimens. *Macrocercus*, Westwood, Partington's Brit. Cycloped. ii. 439 (1836), appropriate only to the ♂ im.

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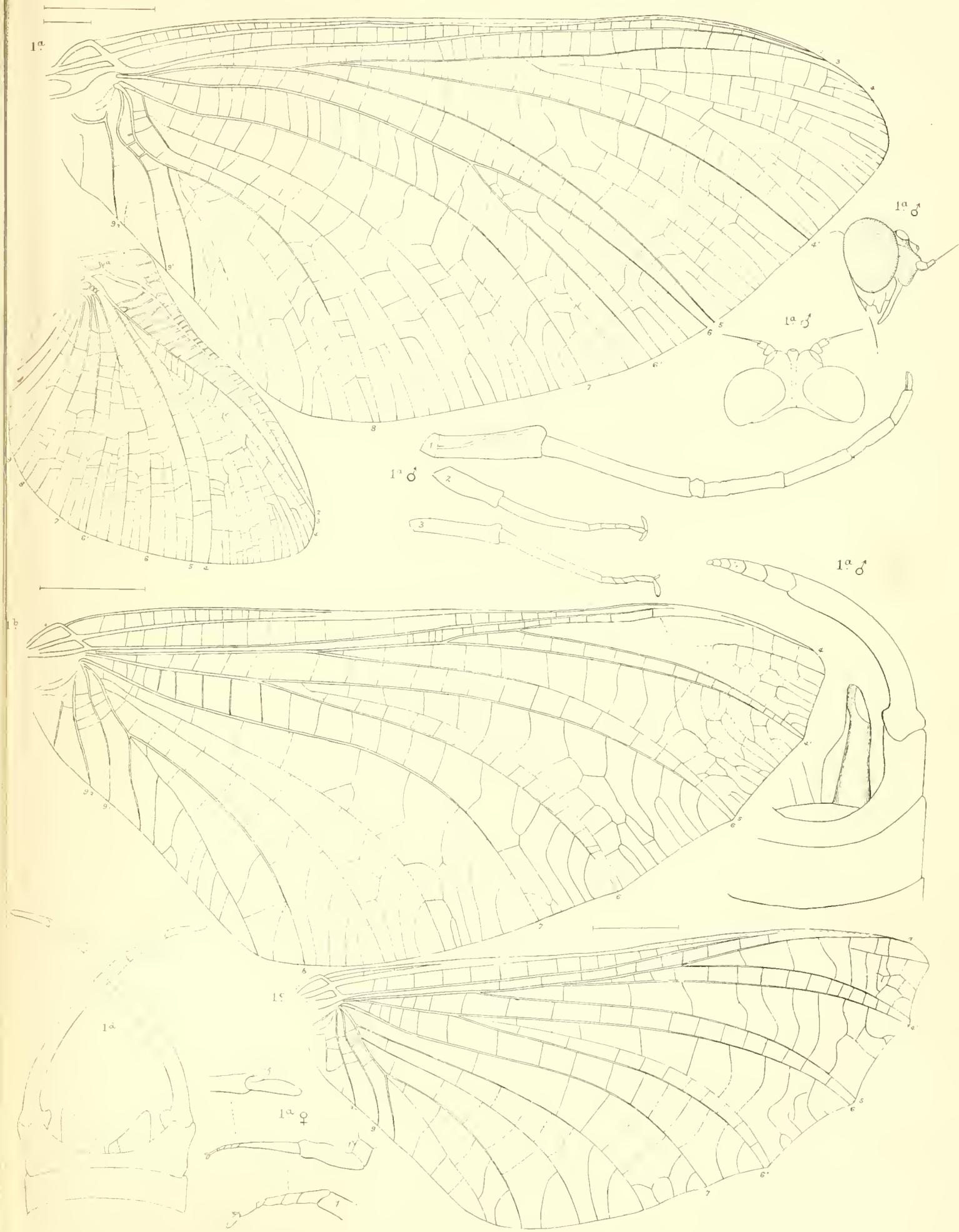
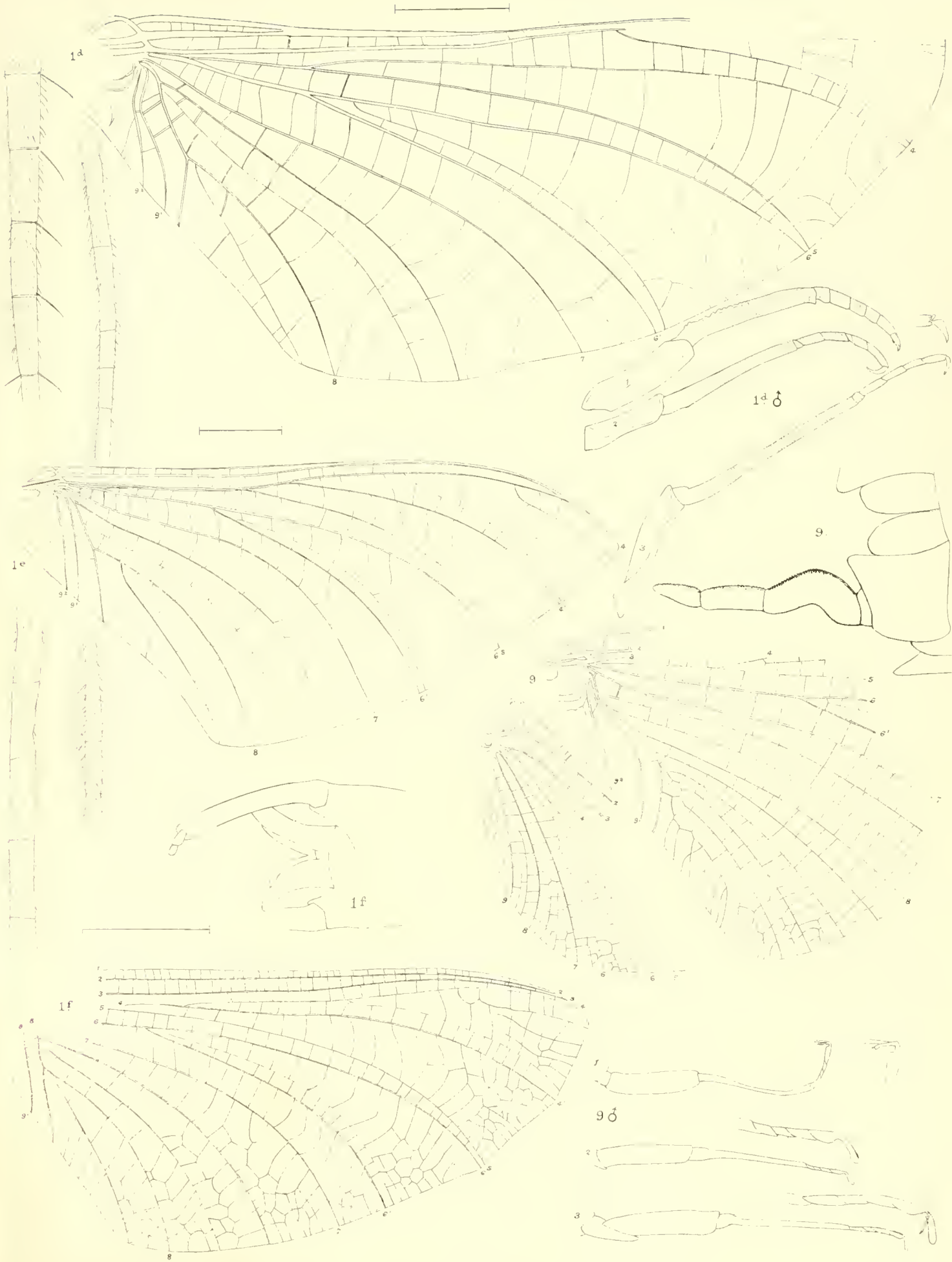


E Eaton del

1. a, P. longicauda; b, P. lata; c, P. ampla; d, P. javanica.

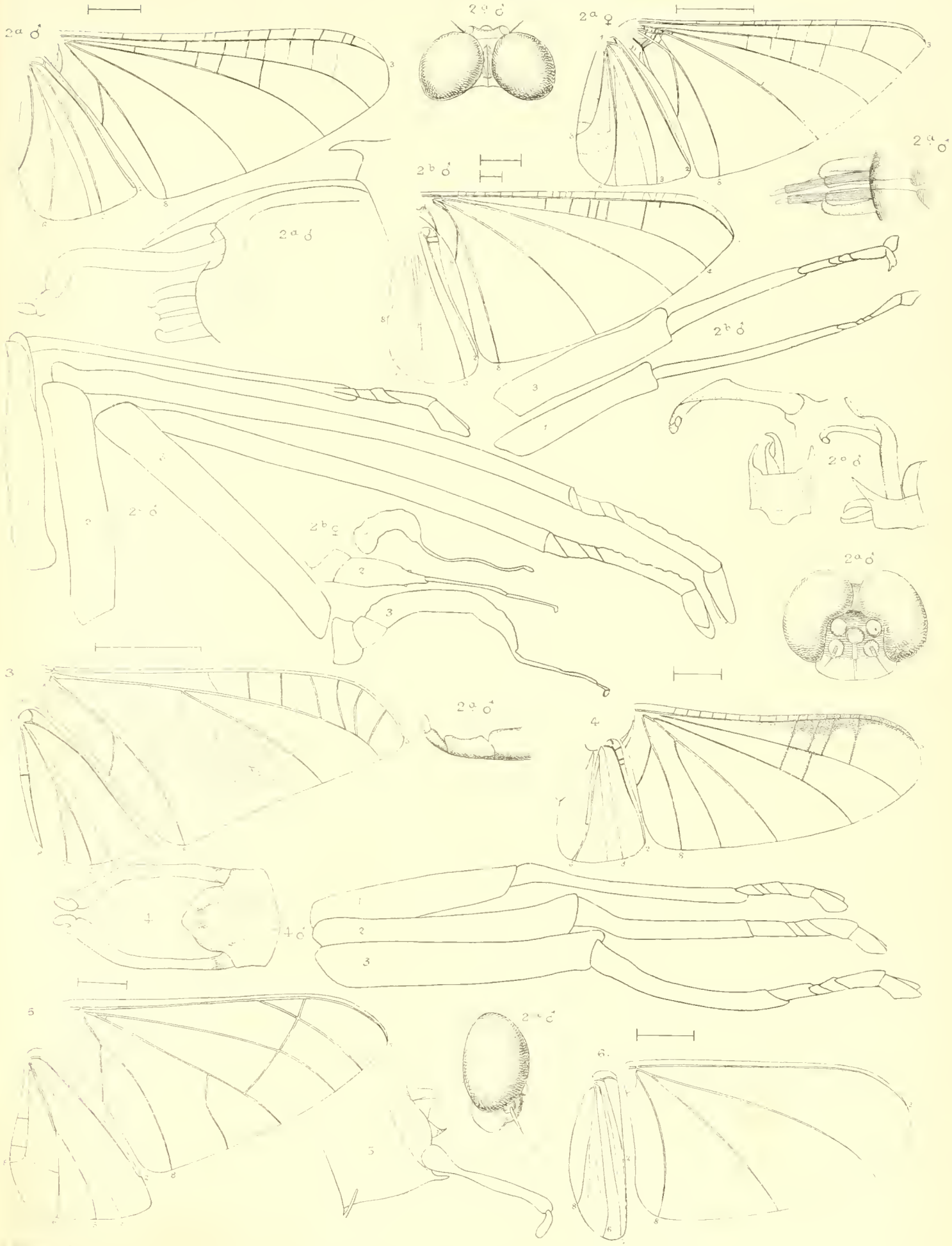
West Newman & Co imp



1d P. javanica; 1e P. tenera; 1f. P. papuana 9. J. Rœseli.

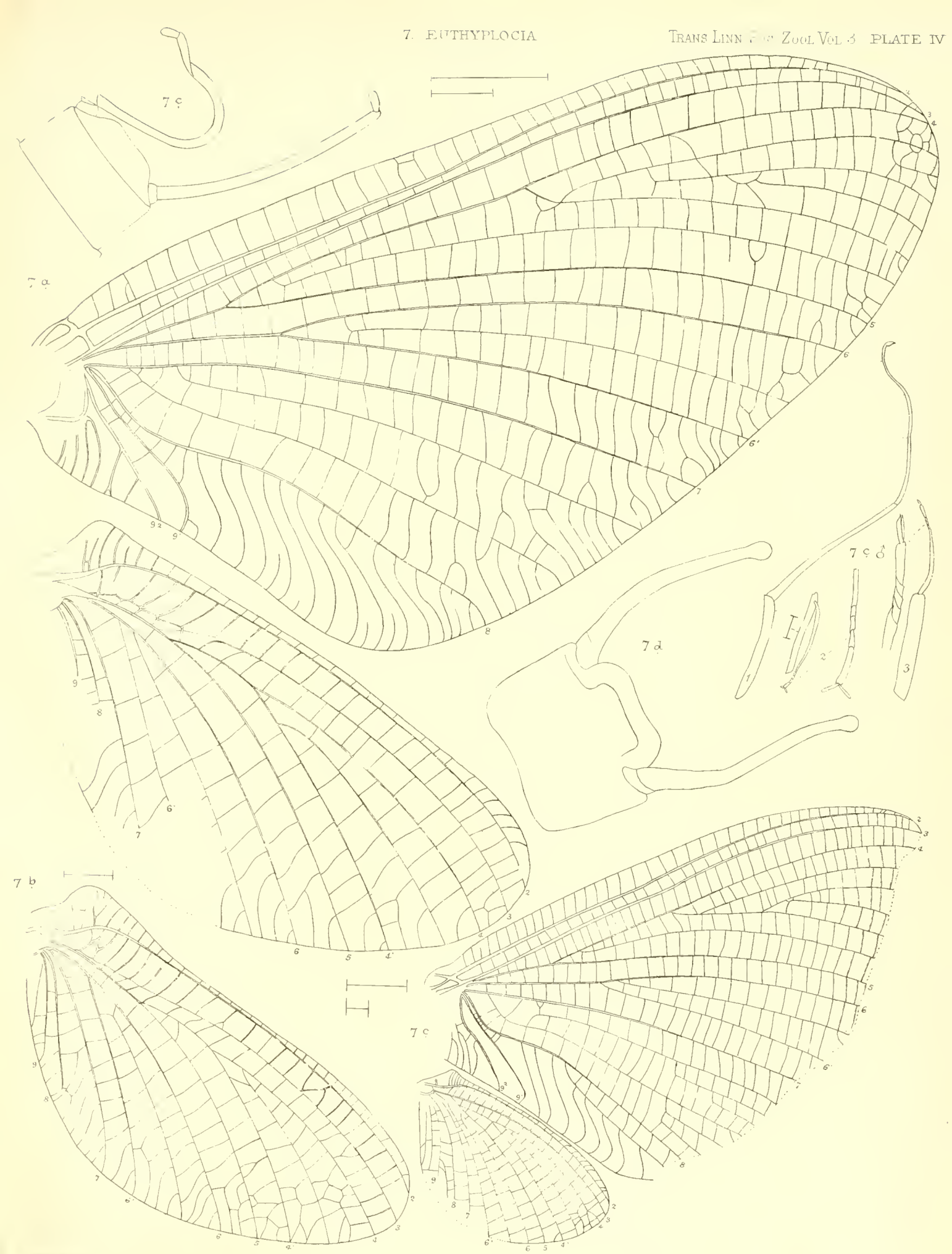
E. Eaton del. West Newman & C° imp.

2. OLIGONEURIA. 3. ELASSONEURIA. 4. SPANIOPHLEBIA,
5. LACHLANIA. 6. HOMŒONEURIA

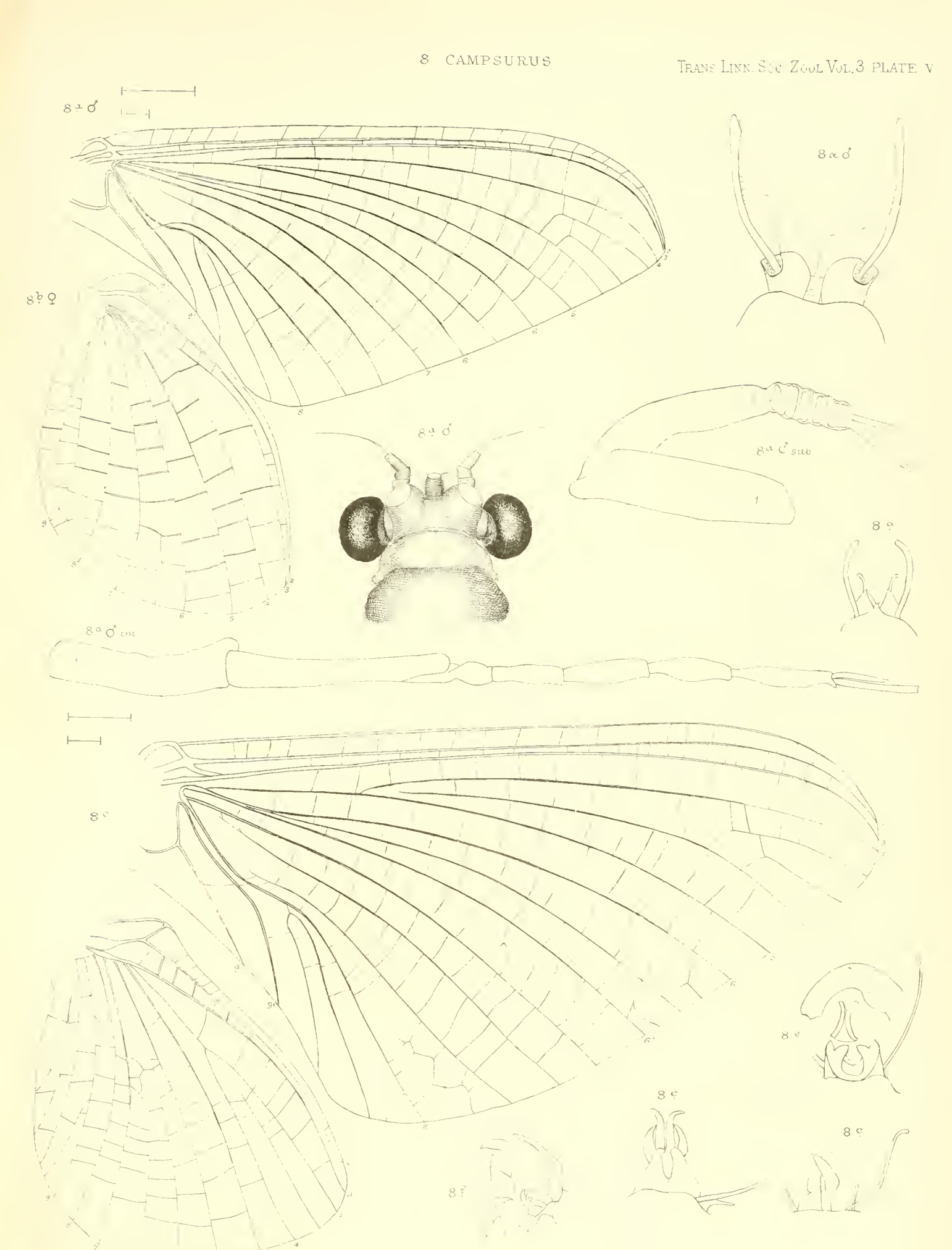


2. O. phenana. b. O. anomala. 3. E. Irmenana.
4. S. Iraliæ. 5. L. abnormis. 6. H. Salviniæ.

West, Newman & Co. imp.



7 a E. Hecuba b c d other species

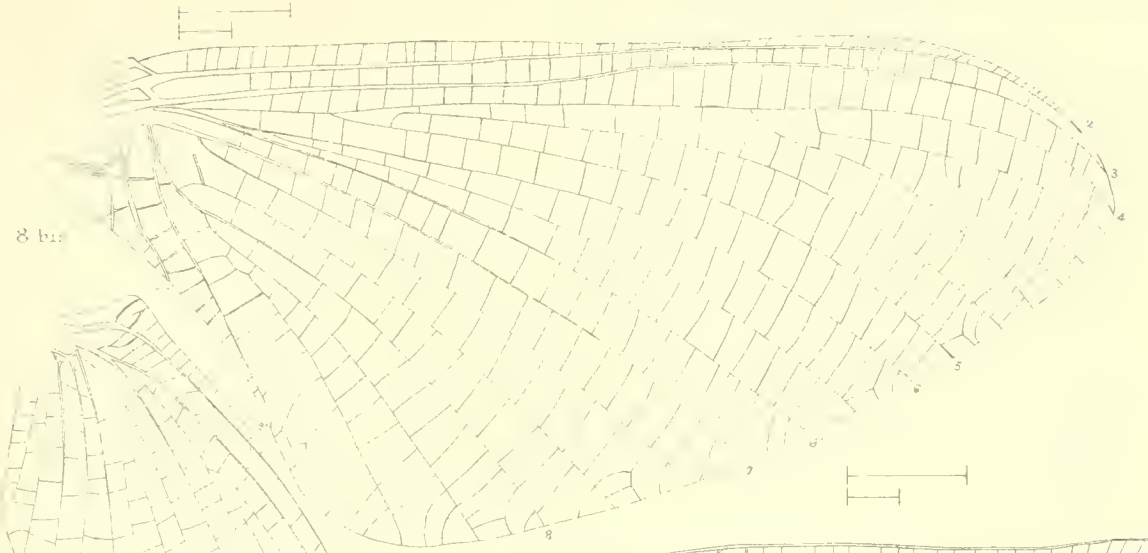


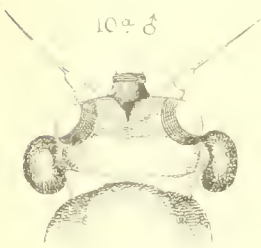
8a ♂ C. albifilum, s. subimago. b ♀, C — sp? Texas, c C. latipennis.
d. C cuspidatus e, C quadridentatus f C curtus

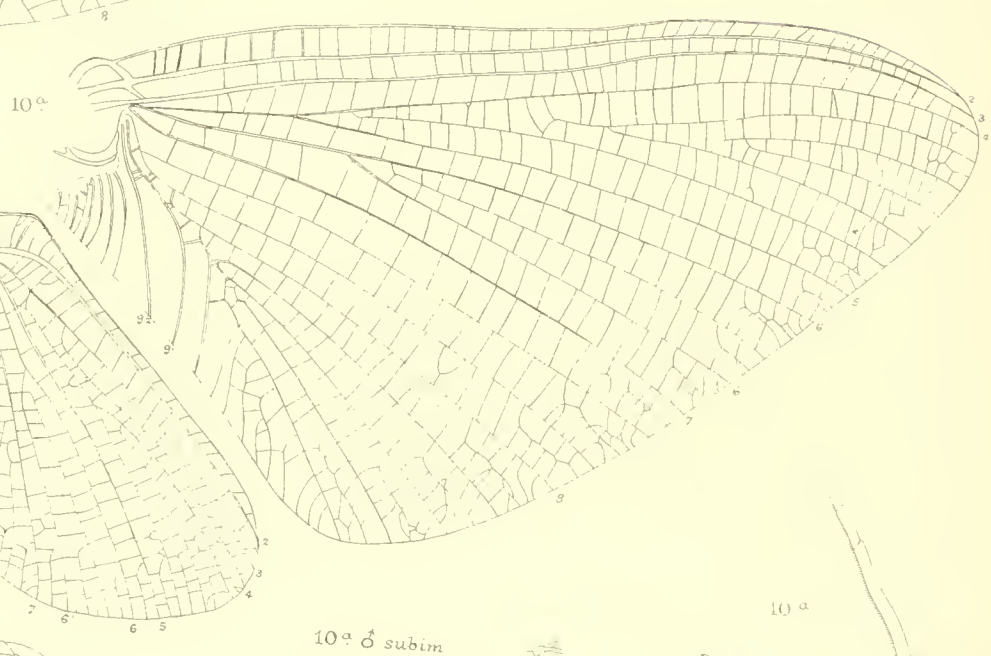
E Exton del

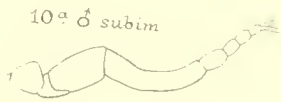
West Newman & Co imp

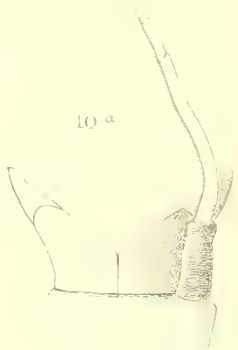
8² RELATED TO CAMPSURUS 9 (VIDE PL. II) 10 POLYMITARCYS

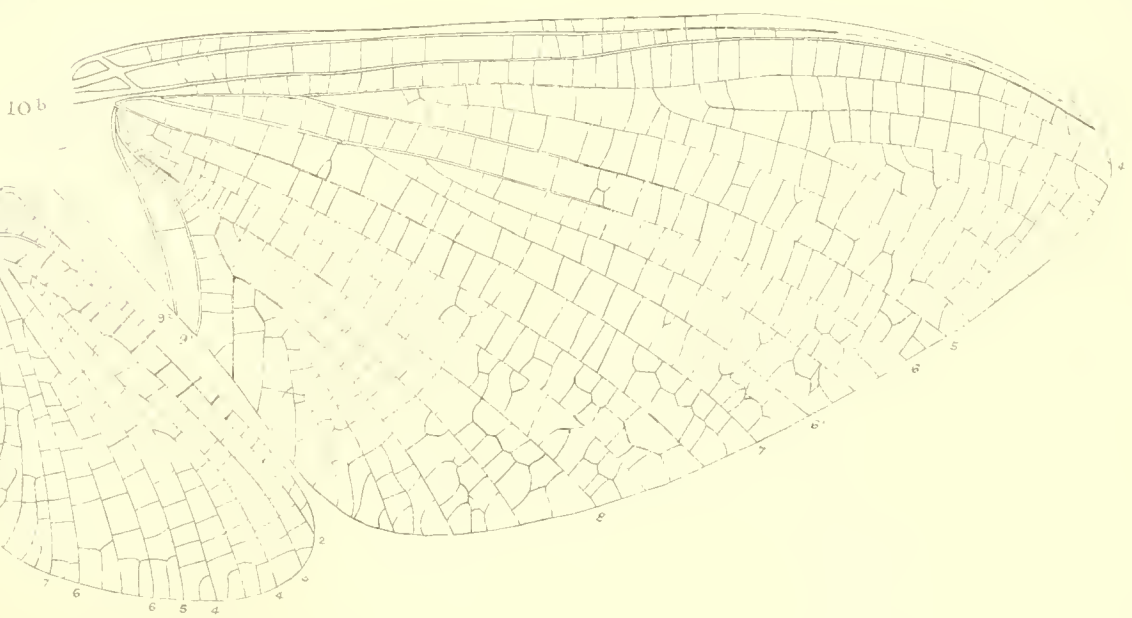


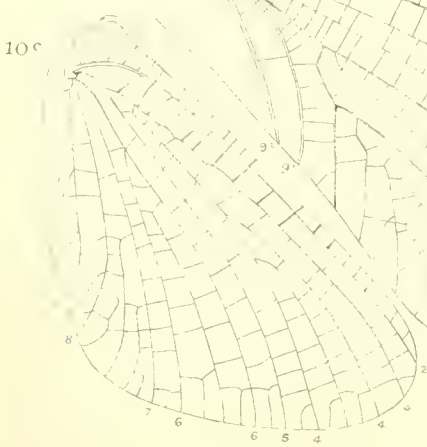












A F Eaton del.

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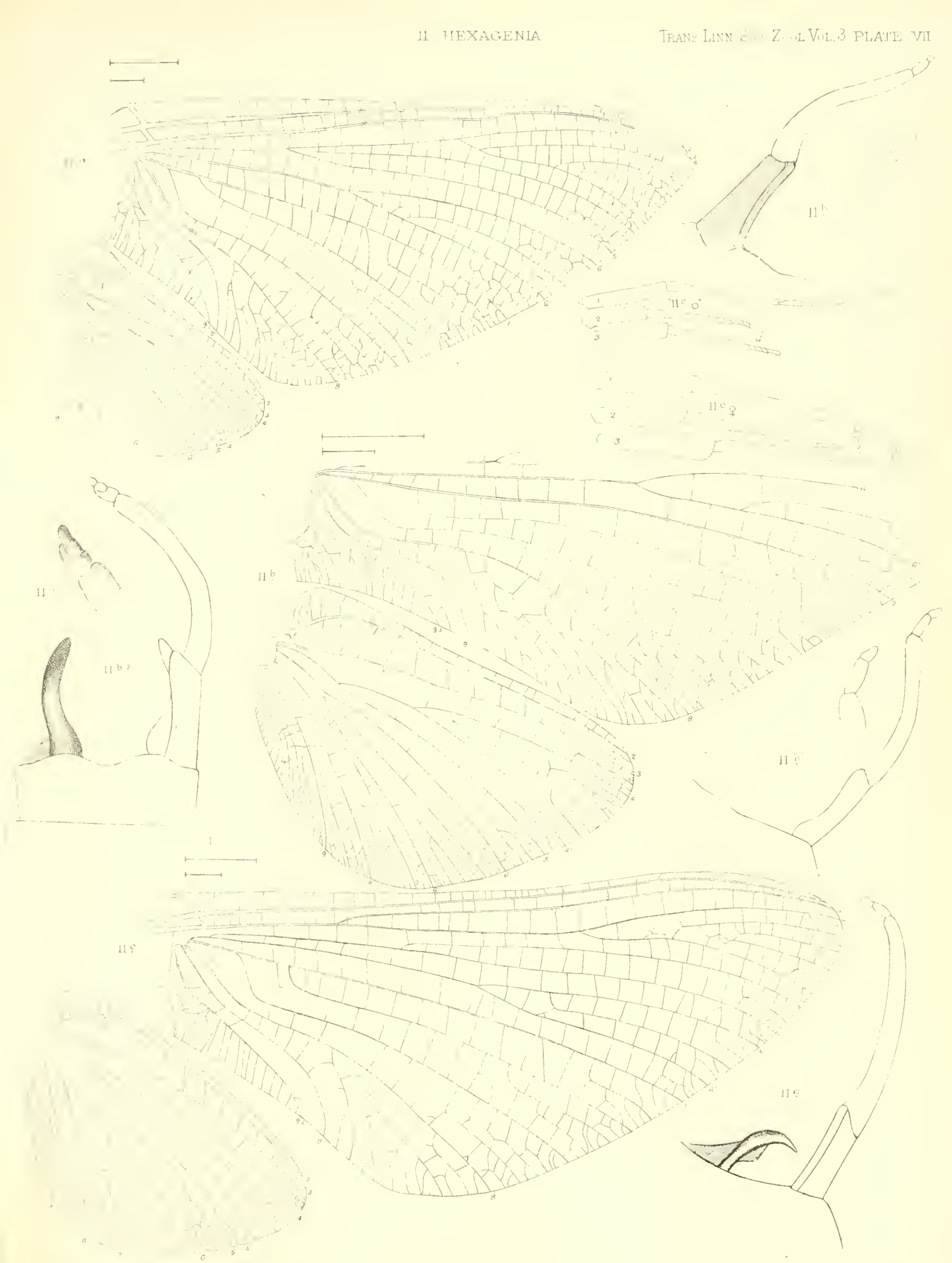
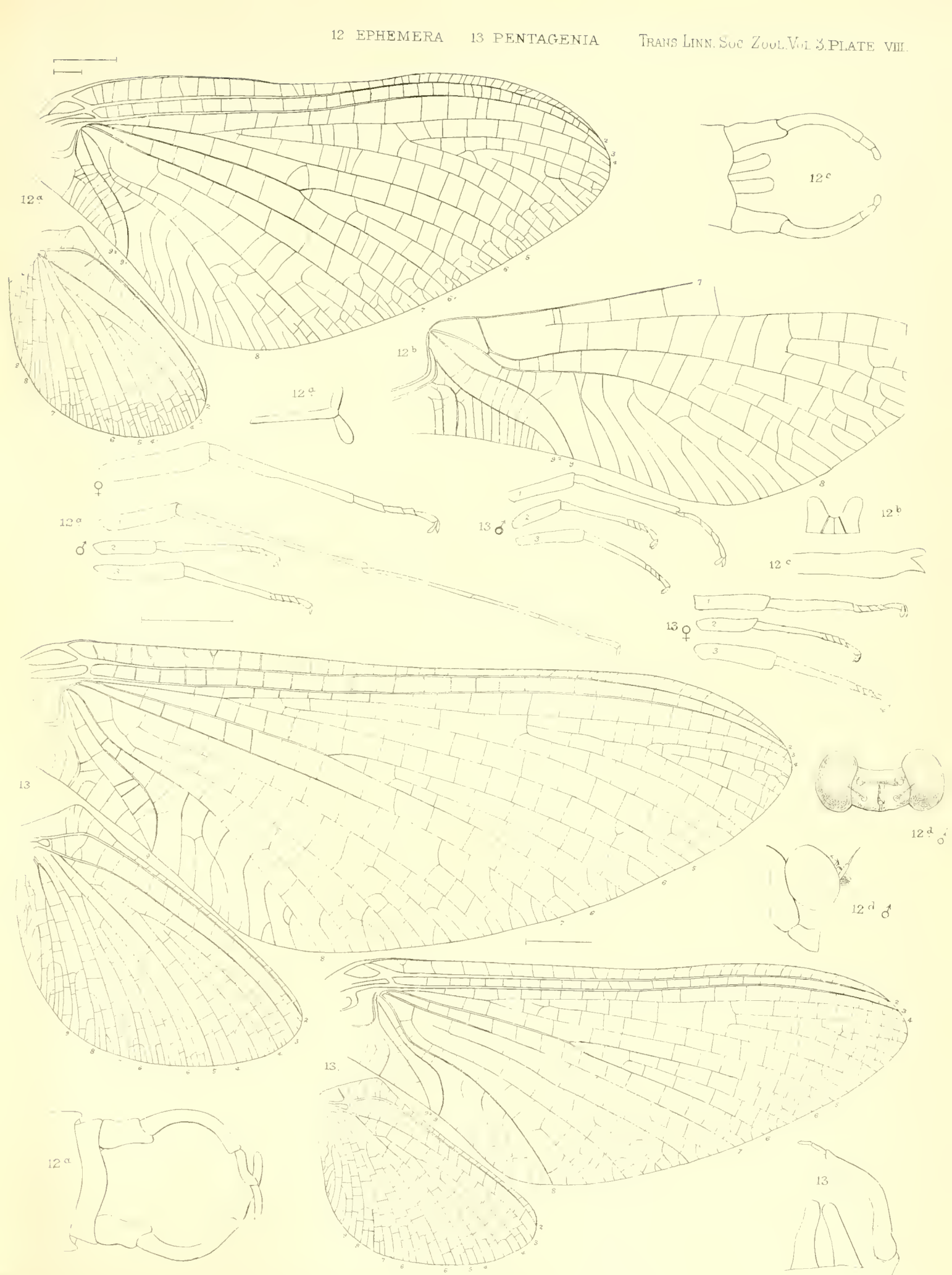
10 a. P. virgo 10 b. S African sp 10 c N W. Indian sp



11a H. N.W. Indian sp. b. H. bilineata c. H. limbata

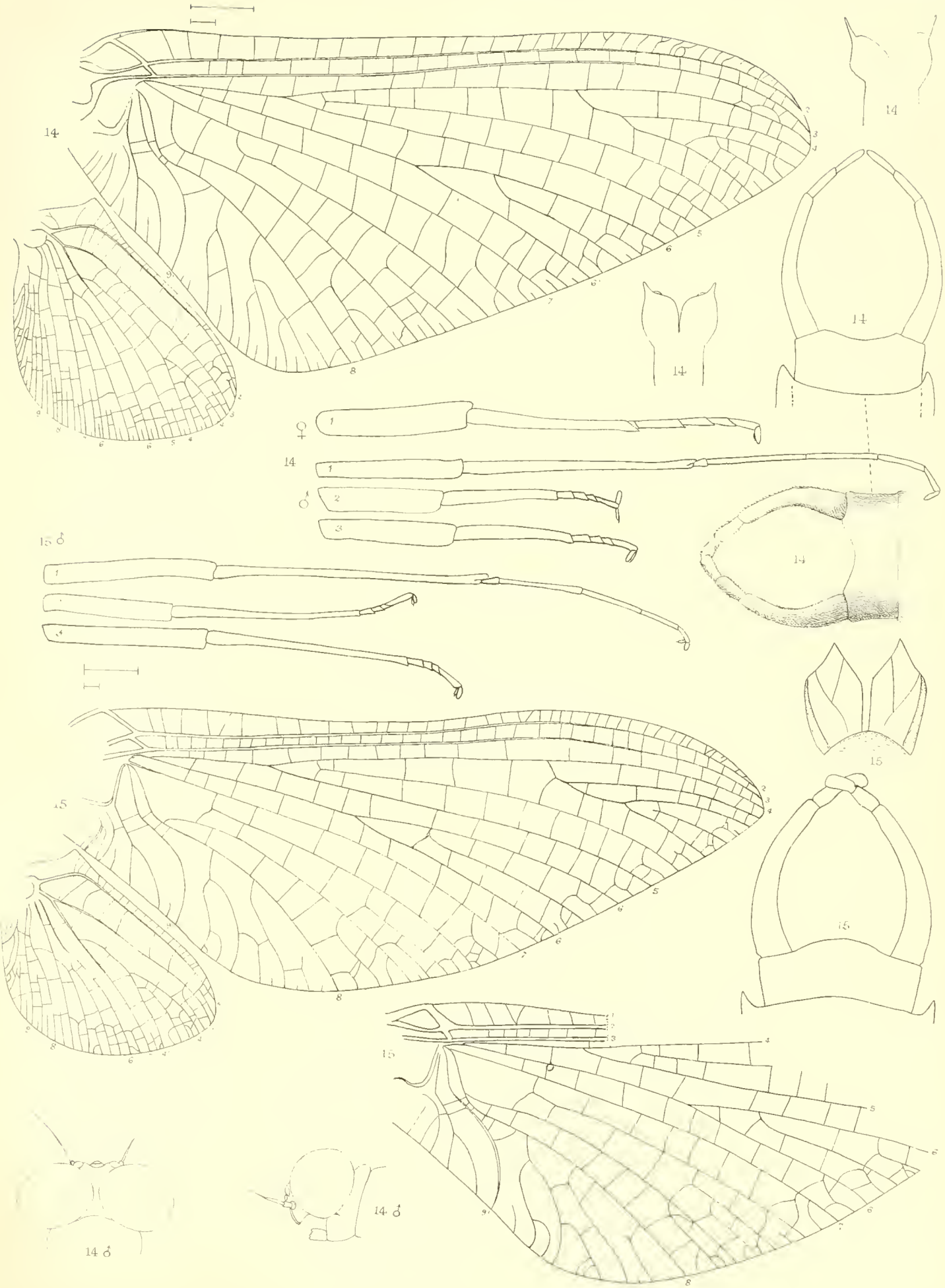
West, Newman & Co. imp.



Eaton del.

12 a, E danica, b F vulgata c E supposita d E glaucops
13 P vittigera

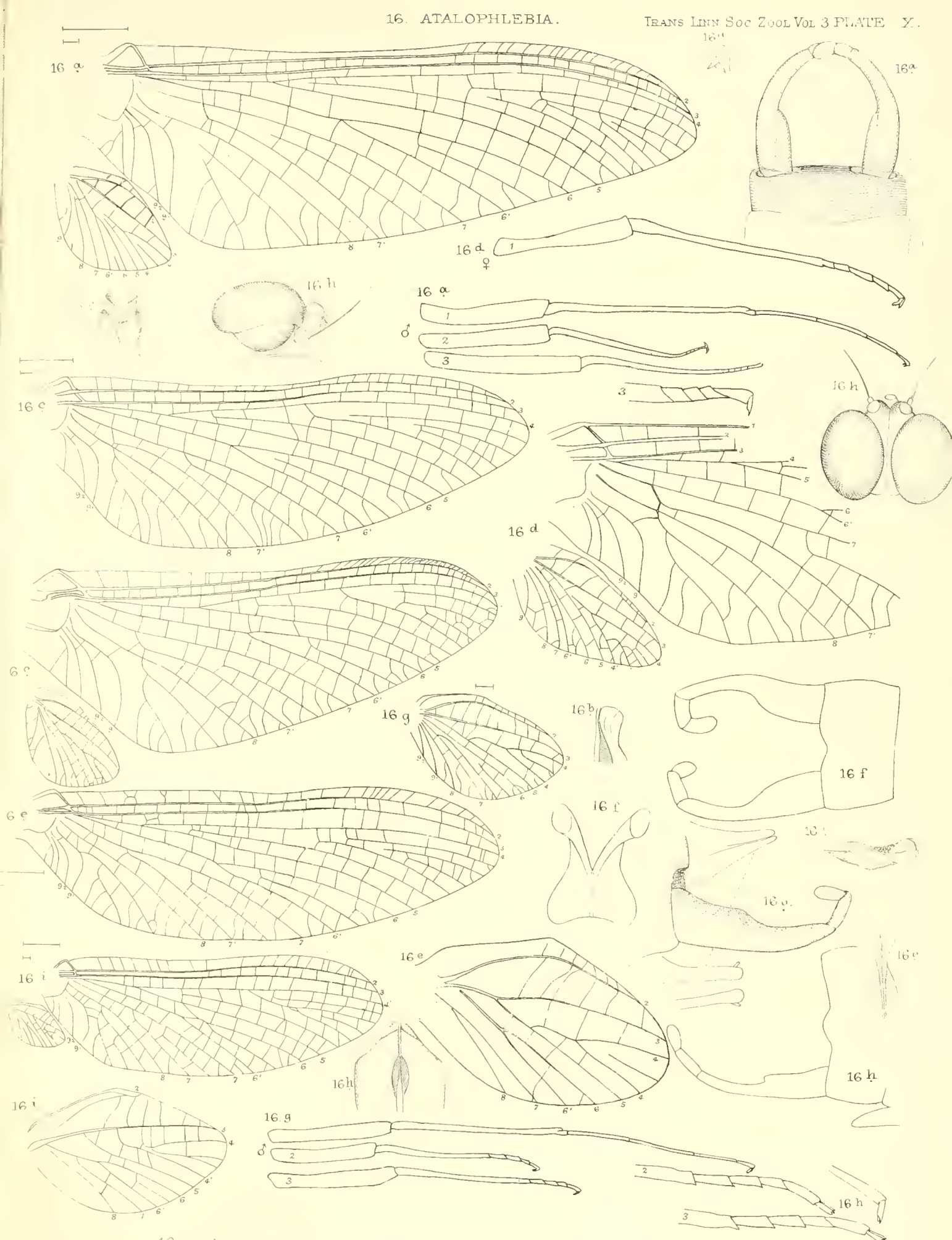
West Newman & Co imp



14. P luteus 15 Rh. speciosus.

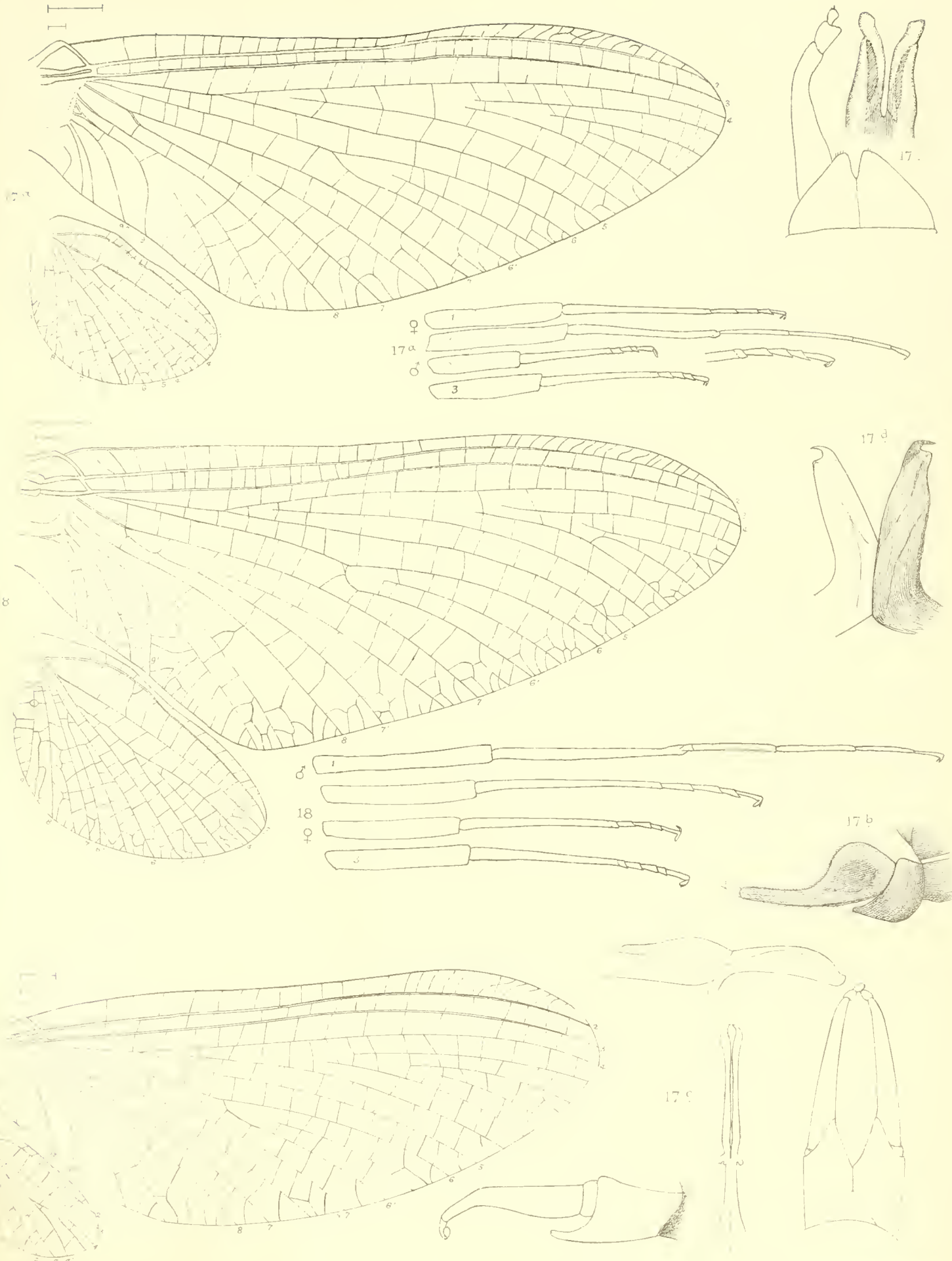
A E Eaton del

West Newman & Co imp

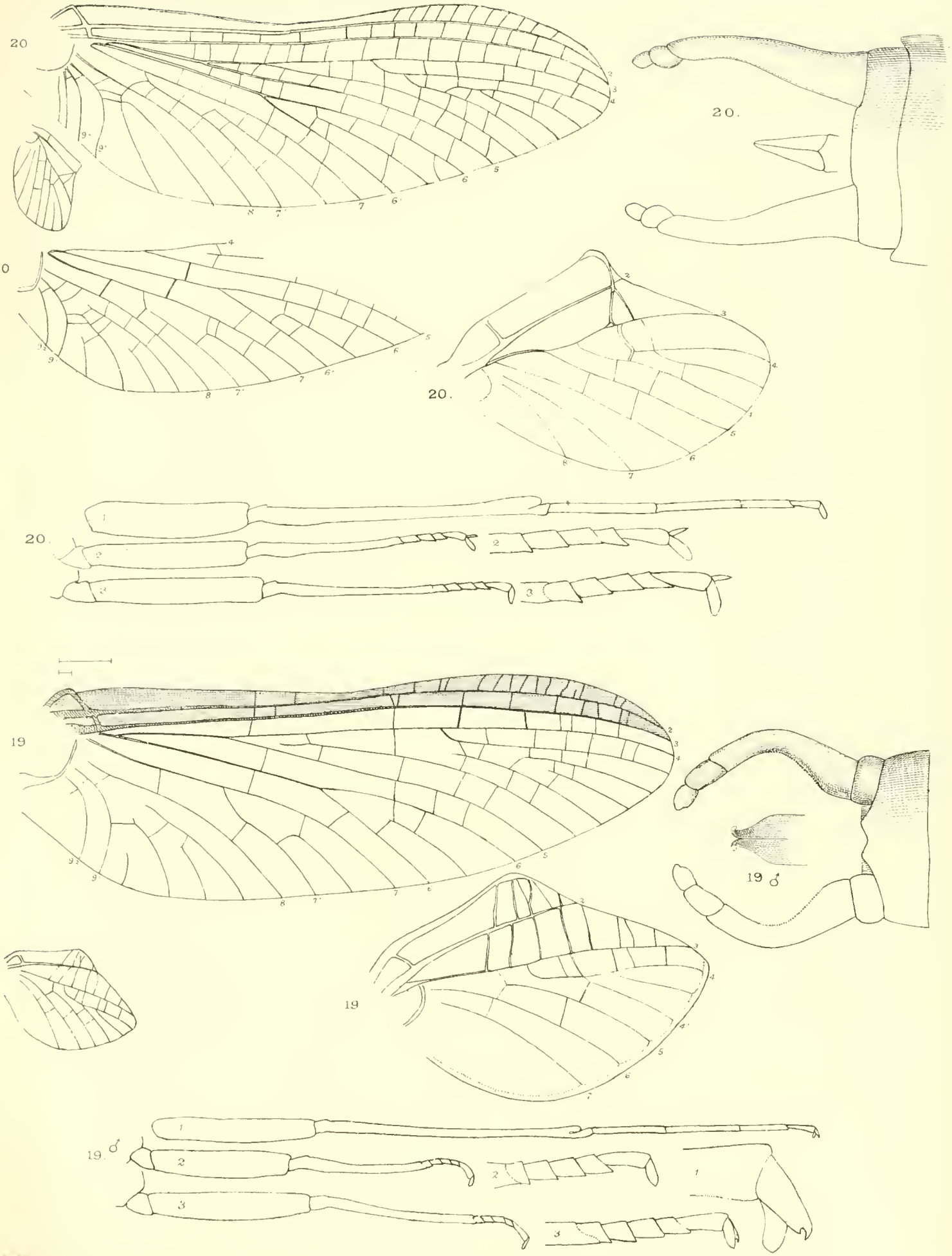


16. a. A. annulata. b. A taprobanes c. A australasica. d. A. strigata.
e A nodularis. f. A. scita g. A chilensis. h. A. tabularis.
i ♂ subim. from Brazil.

Eaton del. West Newman & Co imp.



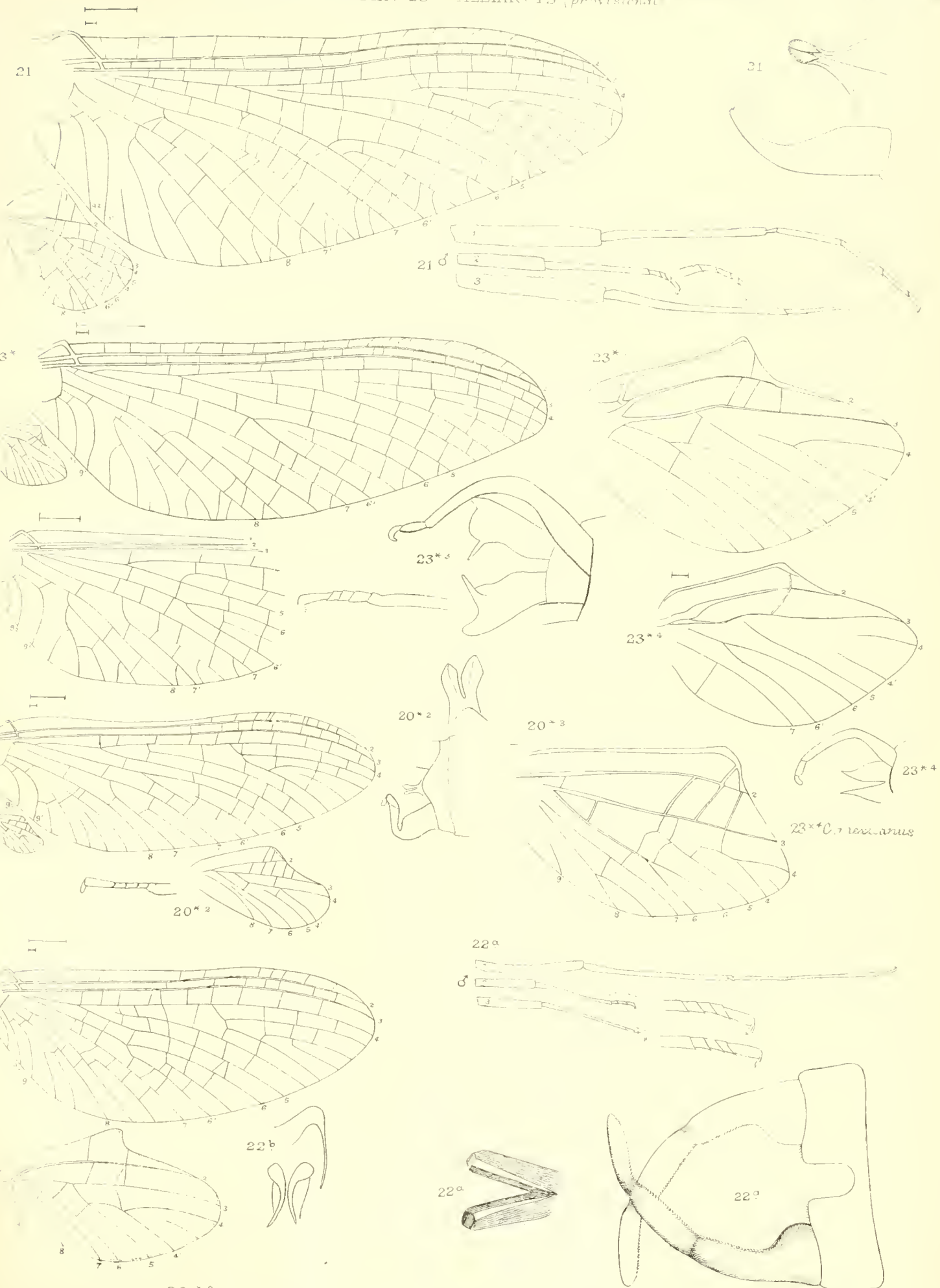
17.a, L marginata b. L mollis c L præpedita
d L Meyeri. 18. B. coccinnus.



19 Ch. Pictetii 20 Th. bellus.

West Newman & C° imp.

20* THRAULUS (provisional) 21 ADENOPHLEBIA 2[illegible]
22. HABROPHLEBIA. 23* CALLIARCYS (provisional)

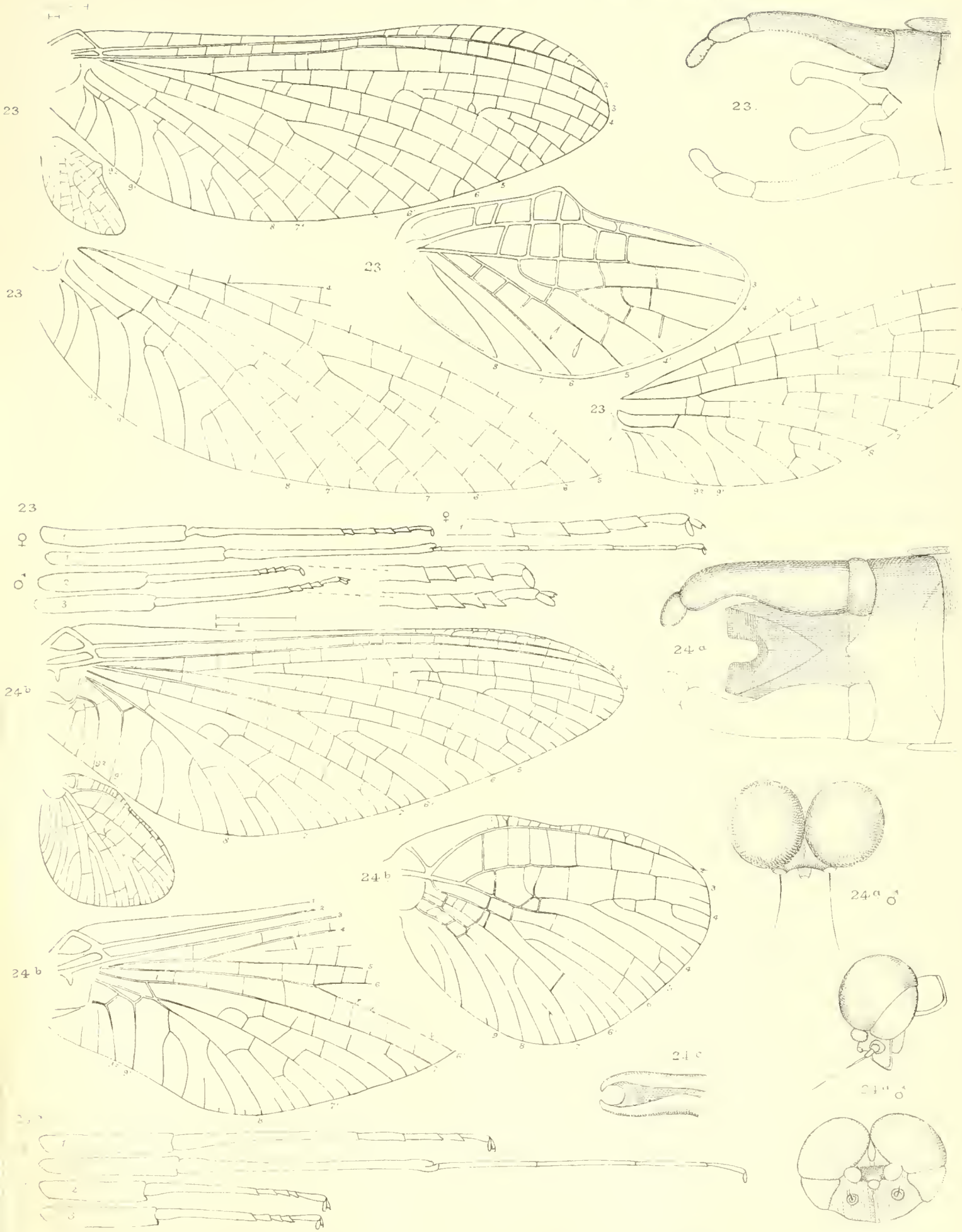


A.E. Eaton del

20*2 Th exiguus 3 Th. colombiæ 21. A. dislocans.
22 a. H. fusca b H. modesta 23*2 C. (Costa Rica. 3 C. lætus

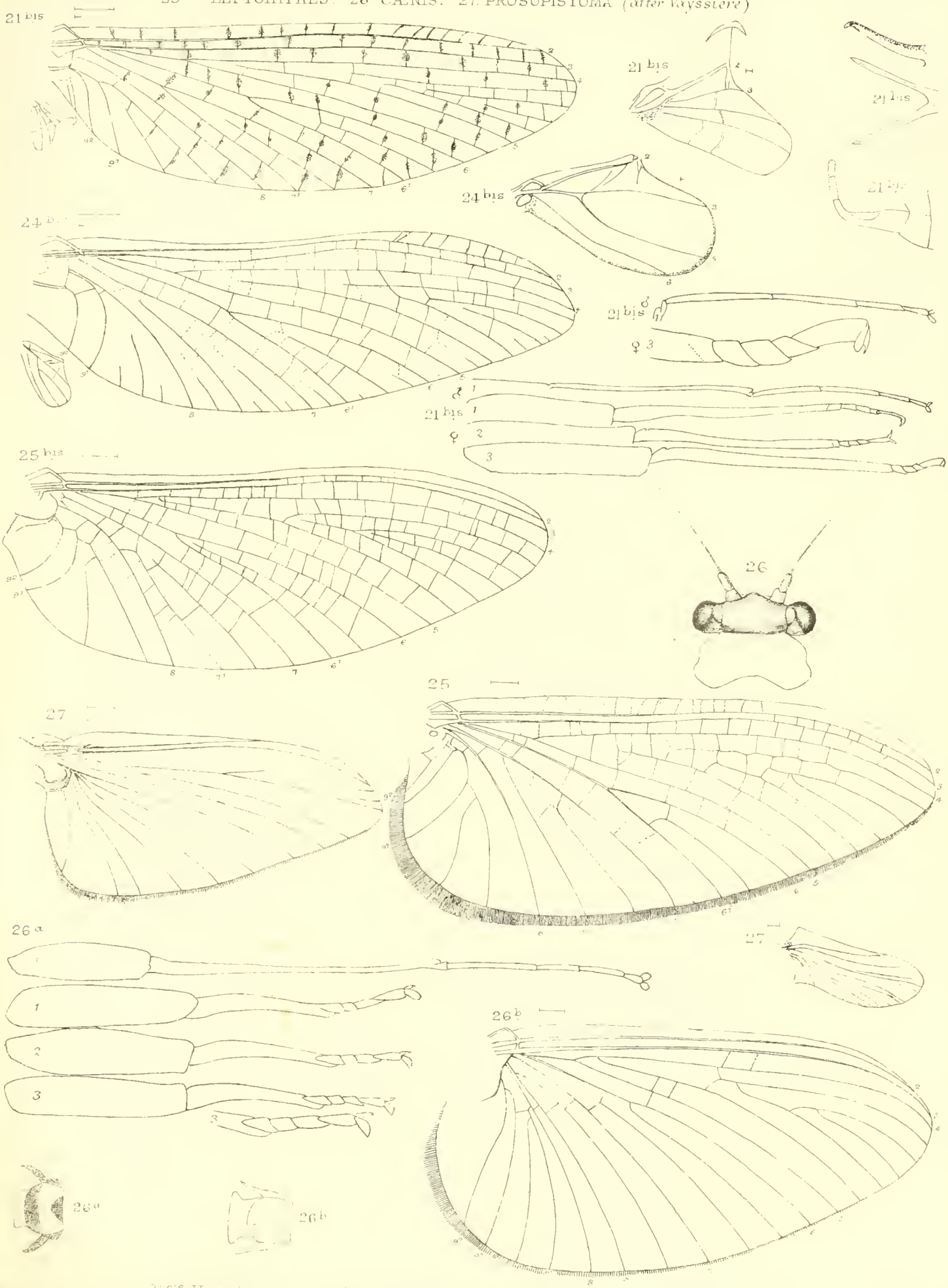
West Newman & Co imp

23 CALLIARCYS 24. E: HEMERELLA



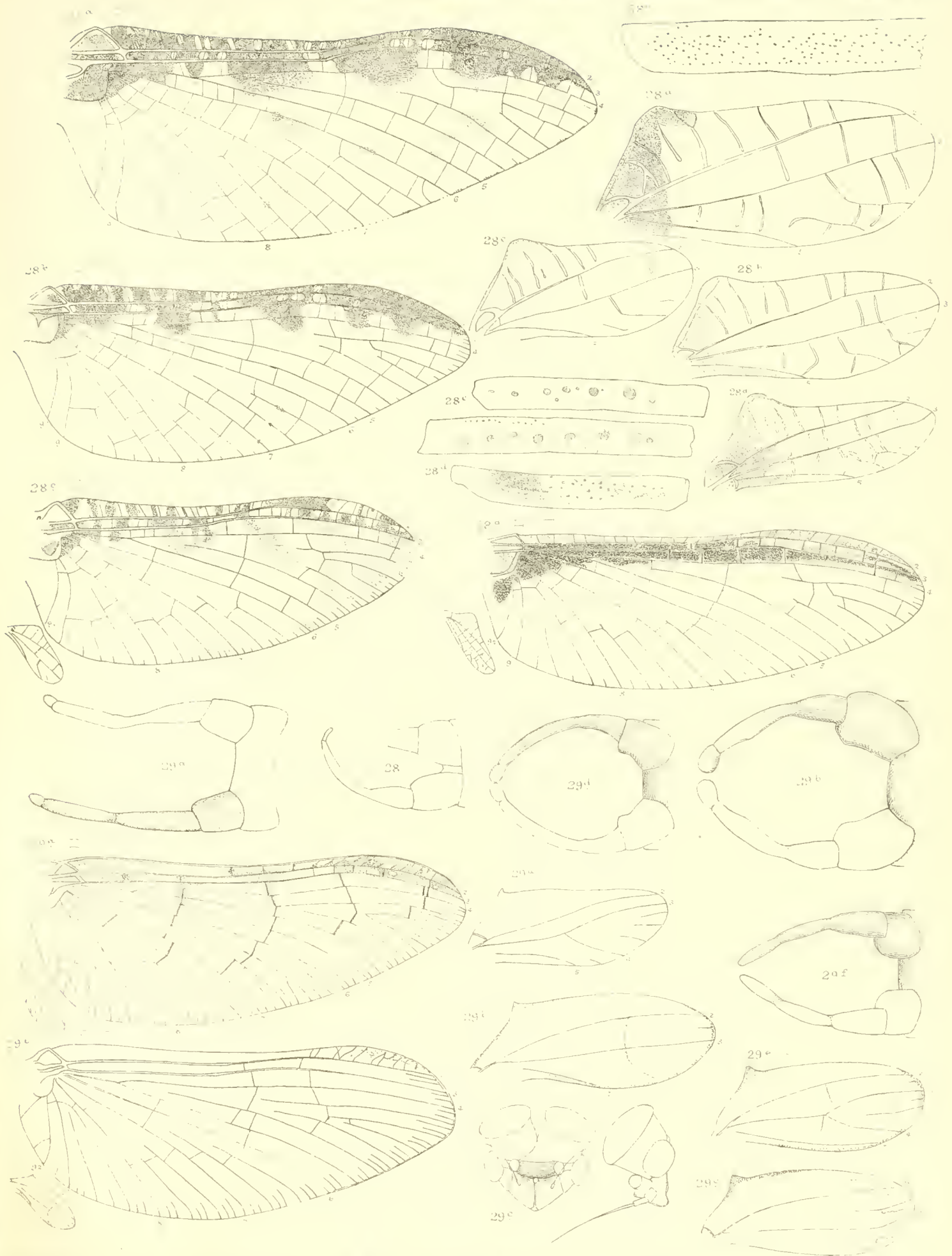
23 C humilis 24 a E iguita b E (N.American) c F

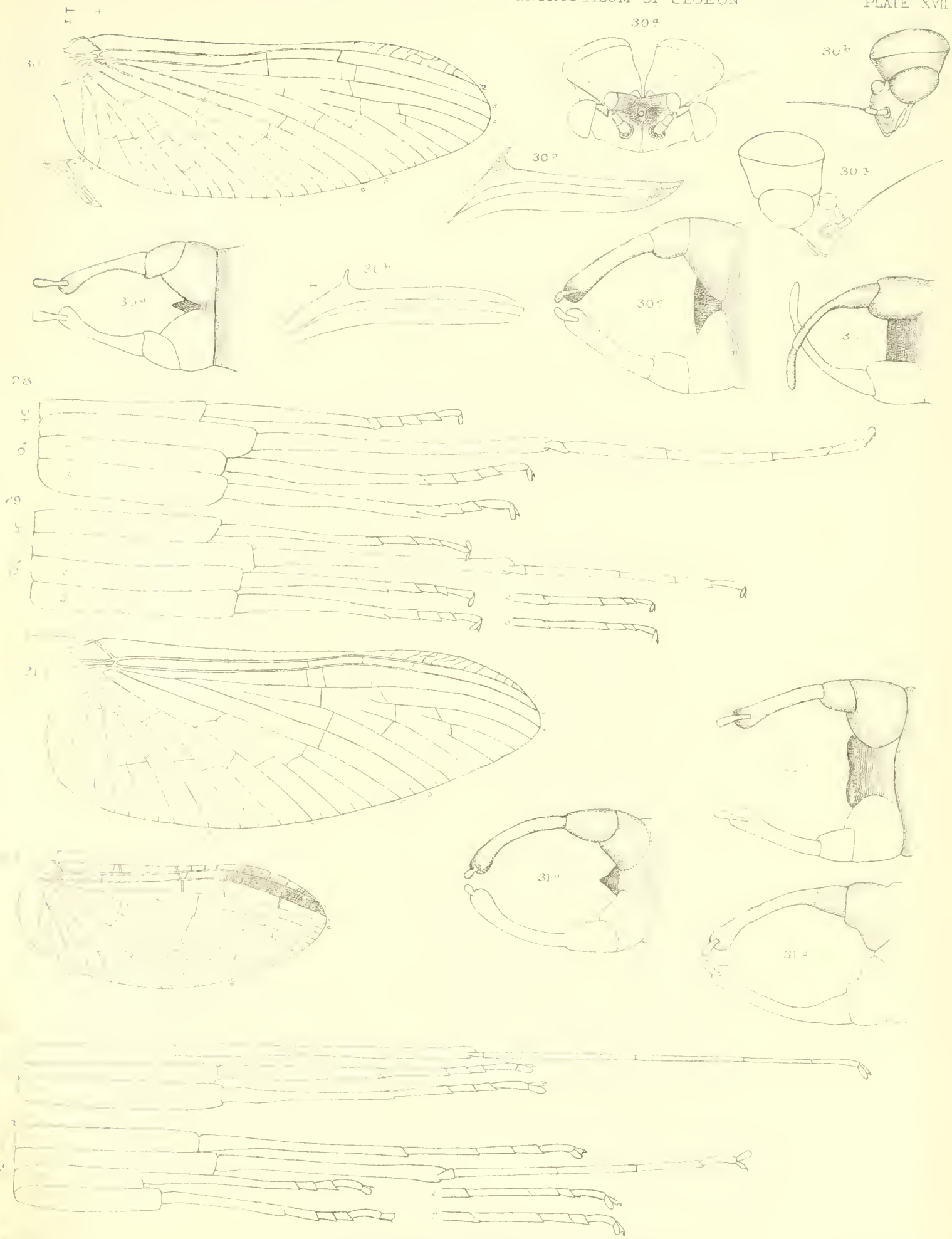
21 bis HAGENULUS (21, Pl. XIII). 24 bis TELOGANODES (24, Pl. XIV). 25. TRICORYTHUS.
25 bis LEPTOHYPHES. 26 CÆNIS. 27. PROSOPISTOMA (*after Vayssière*)



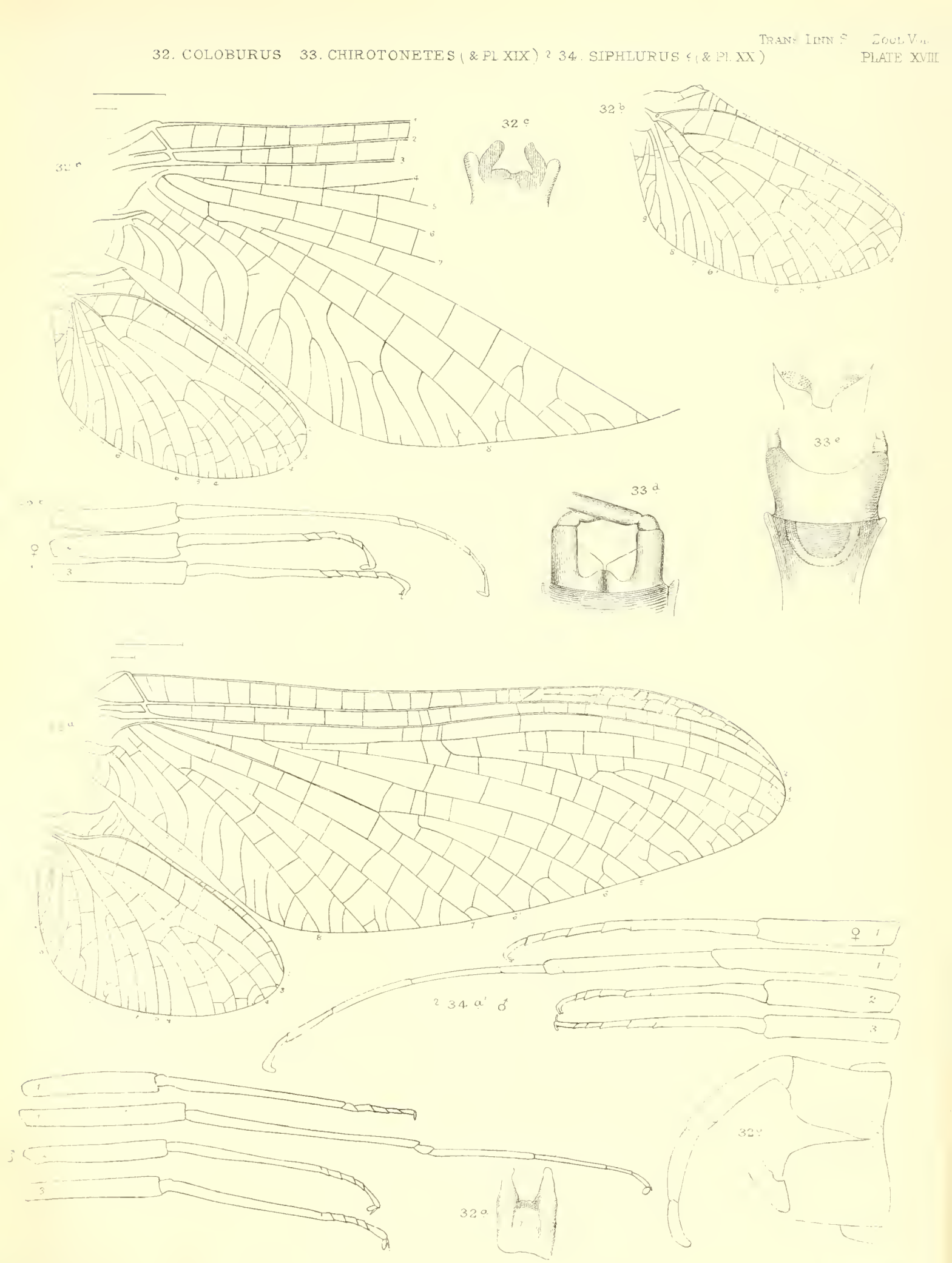
21 bis H. fatigatus. 24 bis T. tristis. 25 T. (Malay sp.) 25 bis L. eximius.
26 a C. halterata. b C. dimidiata. 27. P. punctifrons (*after Vayssière*)

West, Newman & Co. imp.





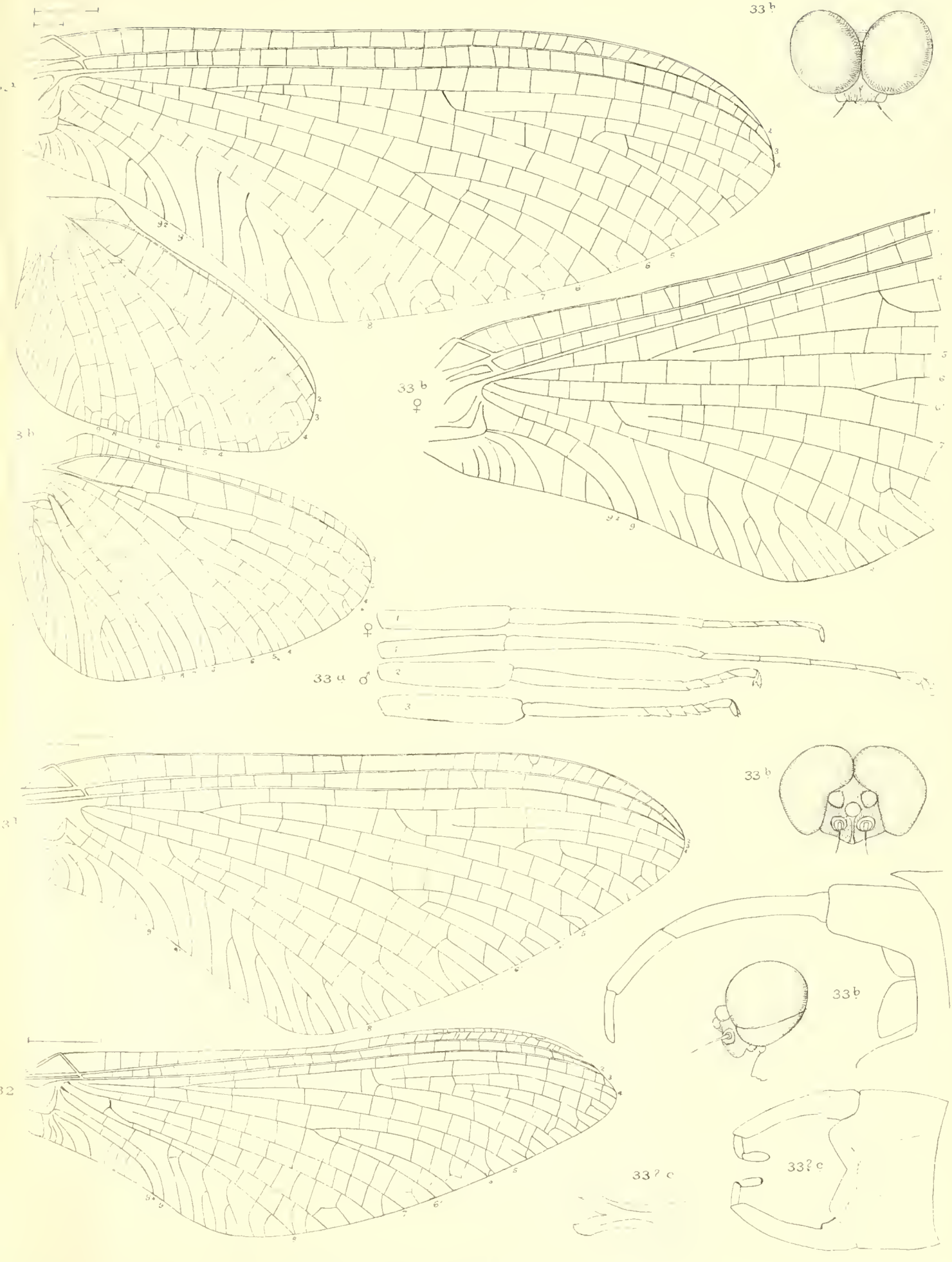
30 a. C luteolum. b C pennulatum. c C tenellum.
31 a. C dipterum. b C simile. c C dimidiatum. d C bimaculatum.



J. F. Eaton del.

32 a, C. humeralis. b. C. (N. America) c C. haleuticus.
33 d Ch. siccus e Ch. aridus. ? 34 a'. S. ? femoratus.

32. COLOBURUS (& PL. XVIII) 33 CHIROTONETES



A. Eaton del.

32. C. haleuticus (& Pl. XVIII) 33 a ch. mancus.
b ch. ignotus c ch. ? ornatus.

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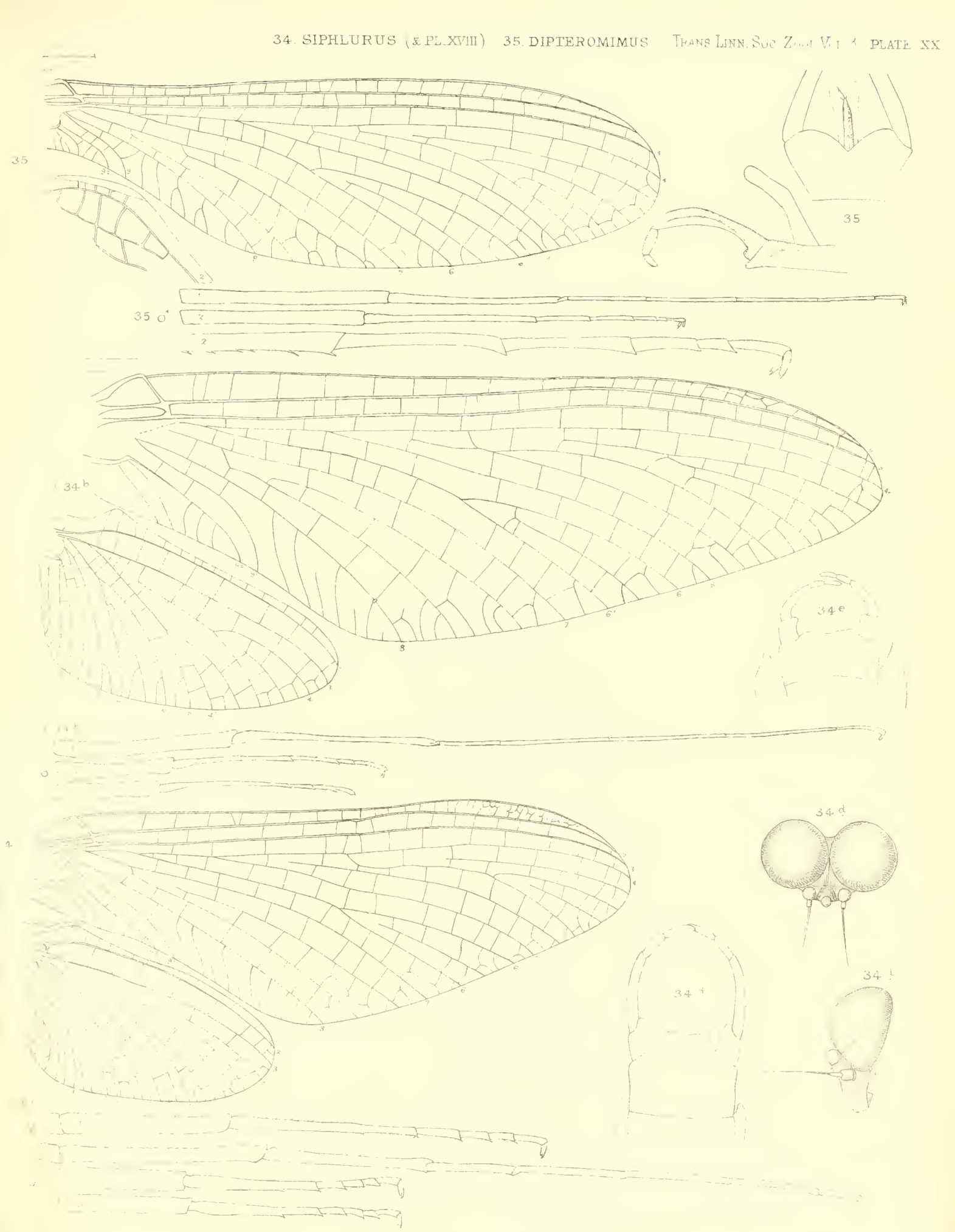
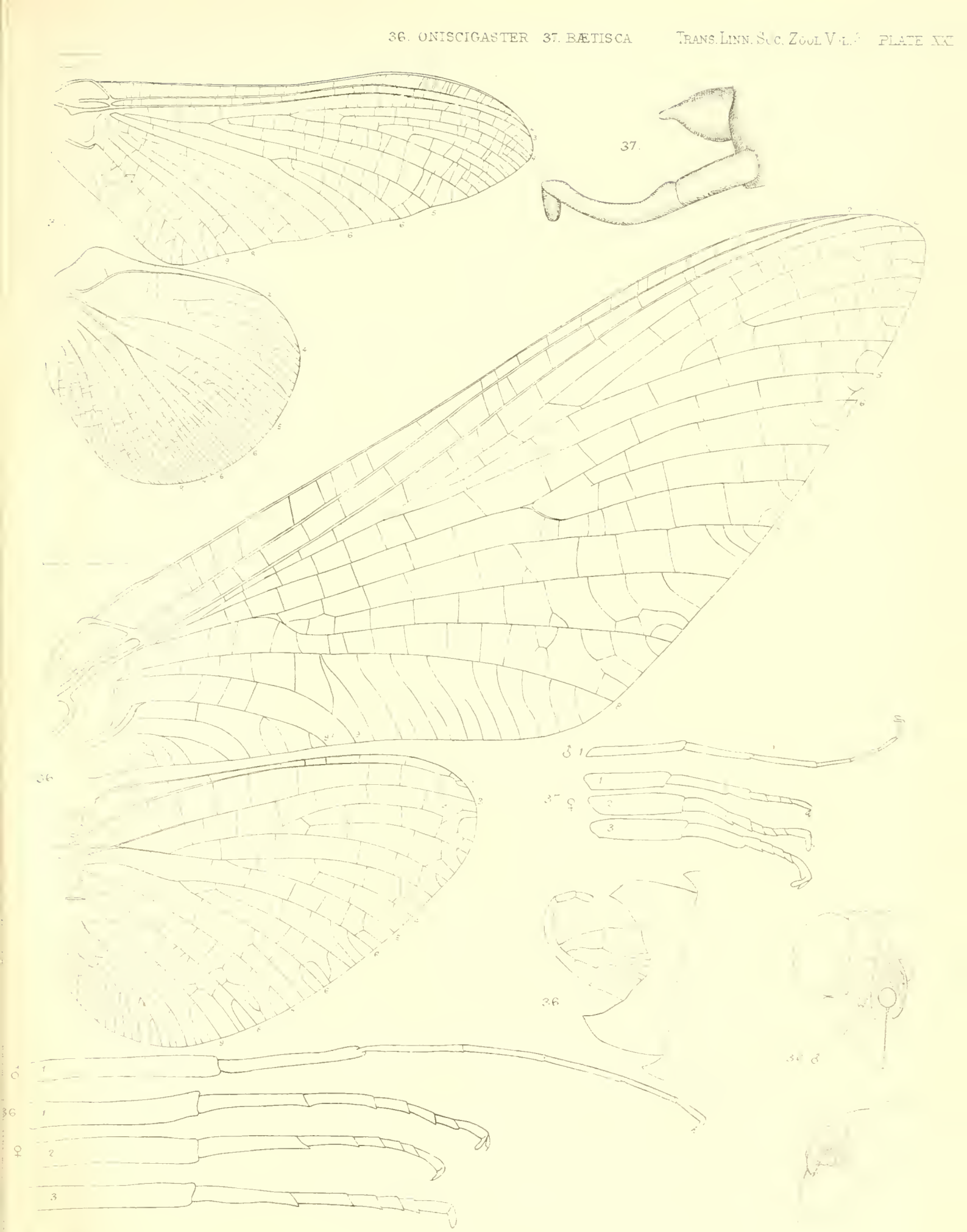
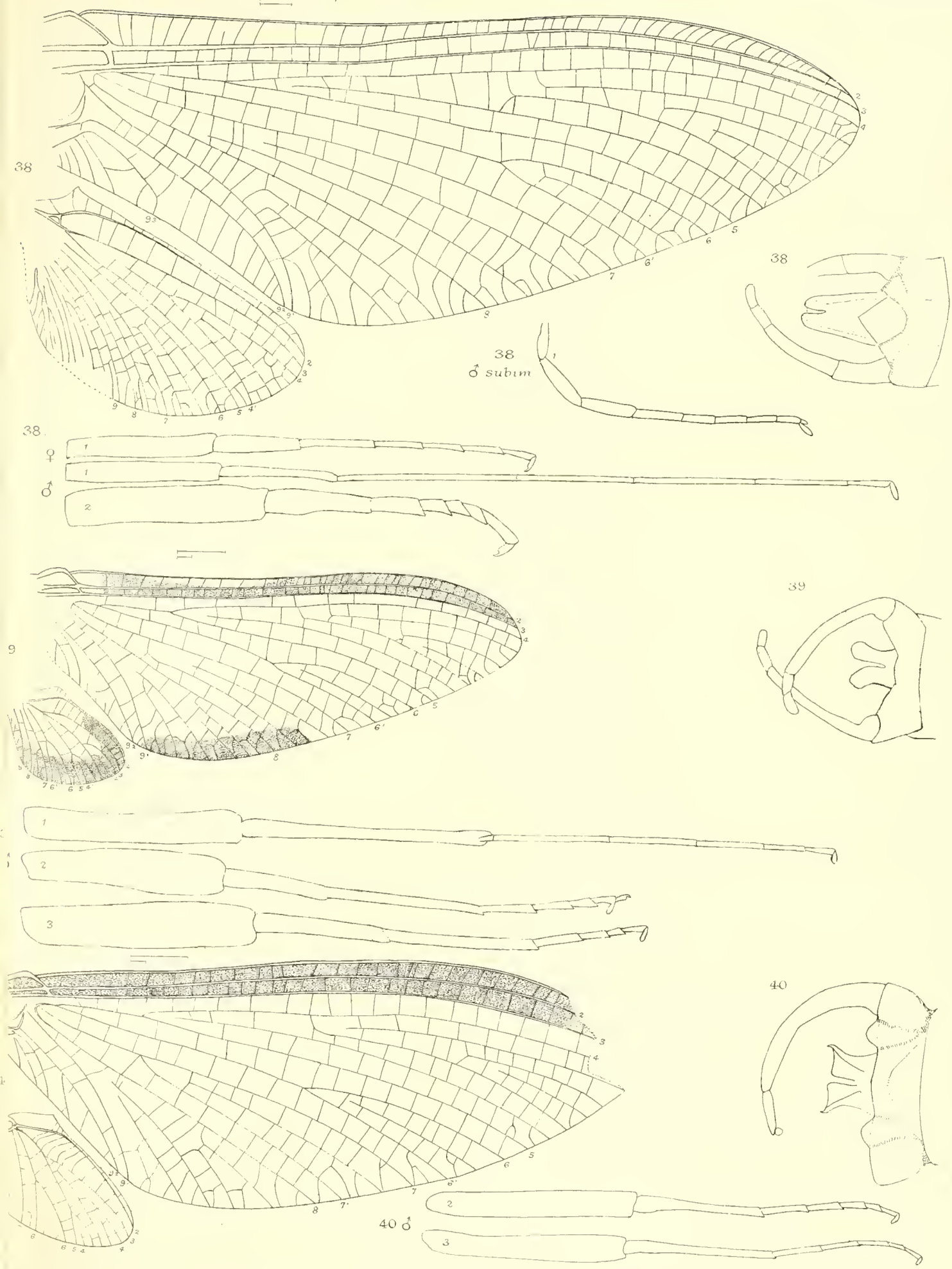


? 34 b. S. anceps. c (normal neuration) d S. lacustris
e S. armatus. 35. D. tipuli[illegible]



36 O Wakefieldi 37 B. obesa

TRANS. LINN. SOC. ZOOL. VOL. 3
PLATE XXII

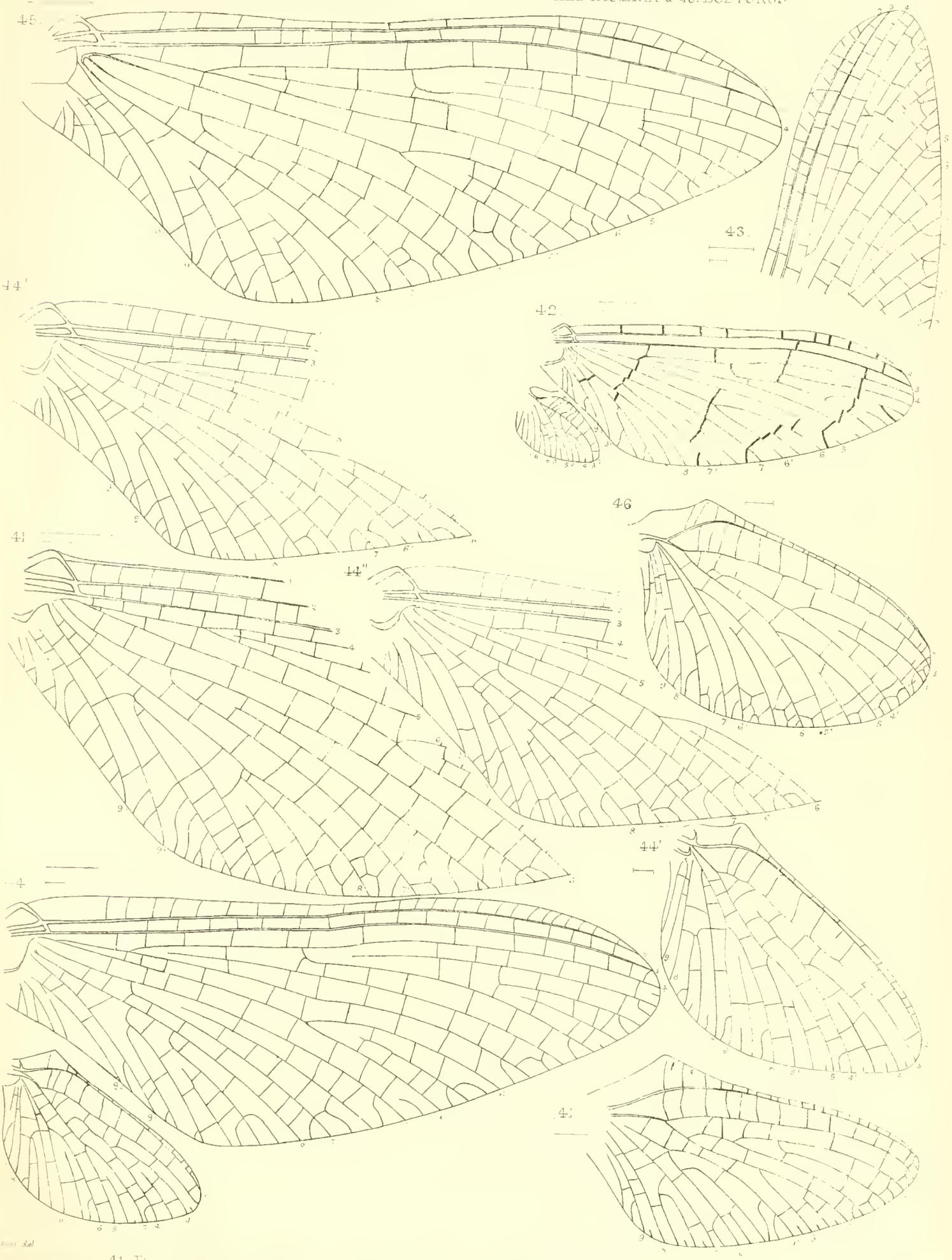


38. A. fragilis 39. A. tarsalis. 40 Th determinatus.

West Newman & Co imp

41 PÆGNIODES. 42 COMPSONEURIA 43–46. LEADING TYPES OF NEURATION COMMON IN 43 RHITHROGENA 44 EPEORUS. 45 HEPTAGENIA & 46. ECDYURUS

PLATE XXIII



41 E. cupulatus 42. C. spectabilis 43. Rh. semicolorata 44. E. longimanus. 45 H. gallica 46. E. venosus.

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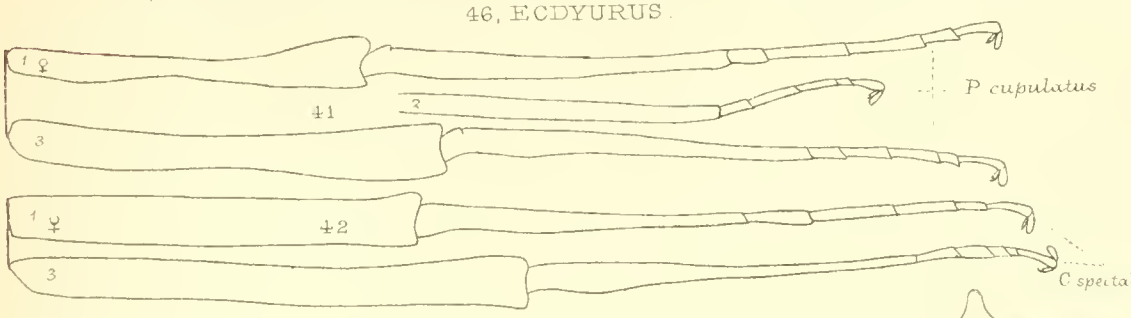
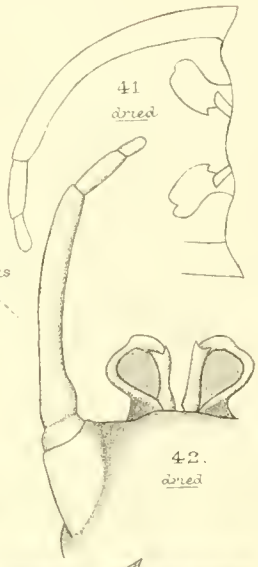
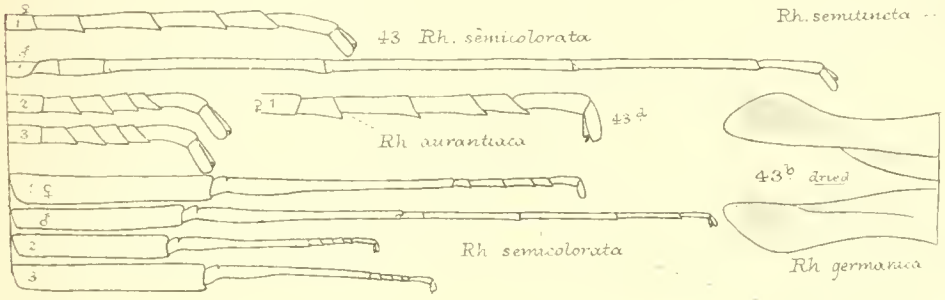
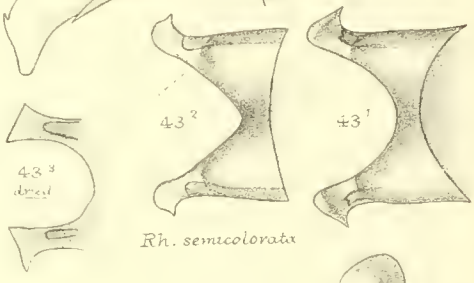
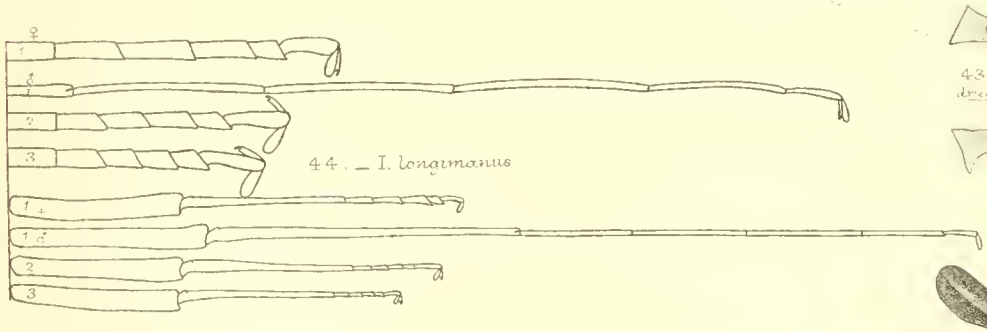
Supplemental to Pl. XXIII. 41, PÆGNIODES 42, COMPSONEURIA
43, RHITHROGENA. 44, (& PL XXIII, 44) IRON. 44A, EPEORUS (*restricted*) 45, HEPTAGENIA
46, ECDYURUS.

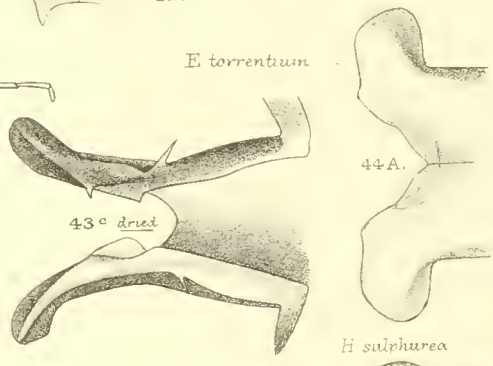


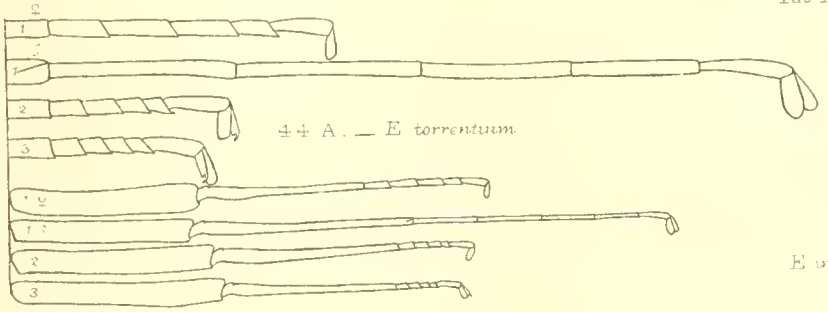


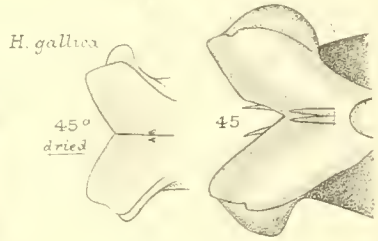


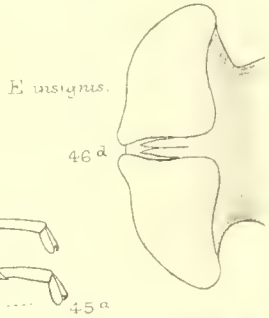


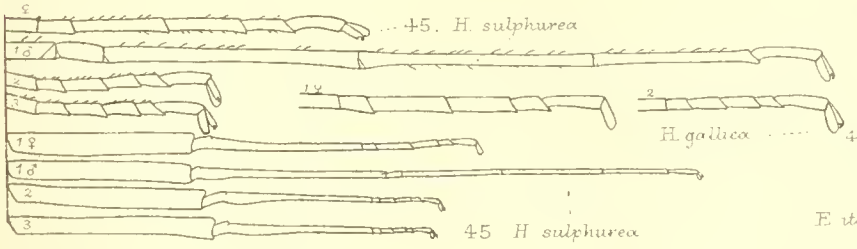


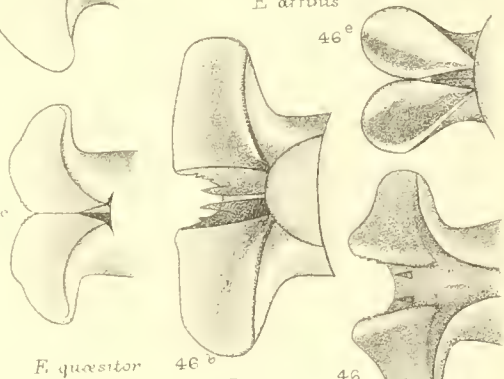


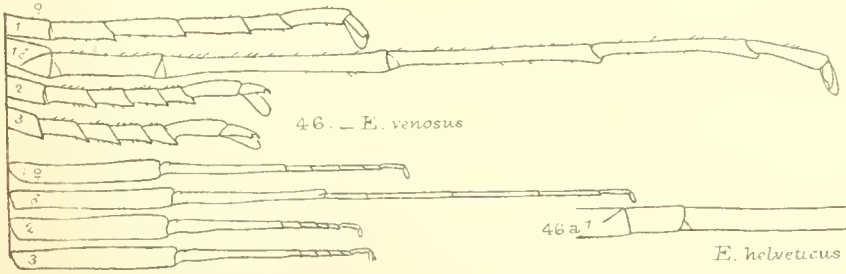


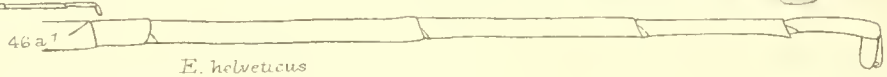








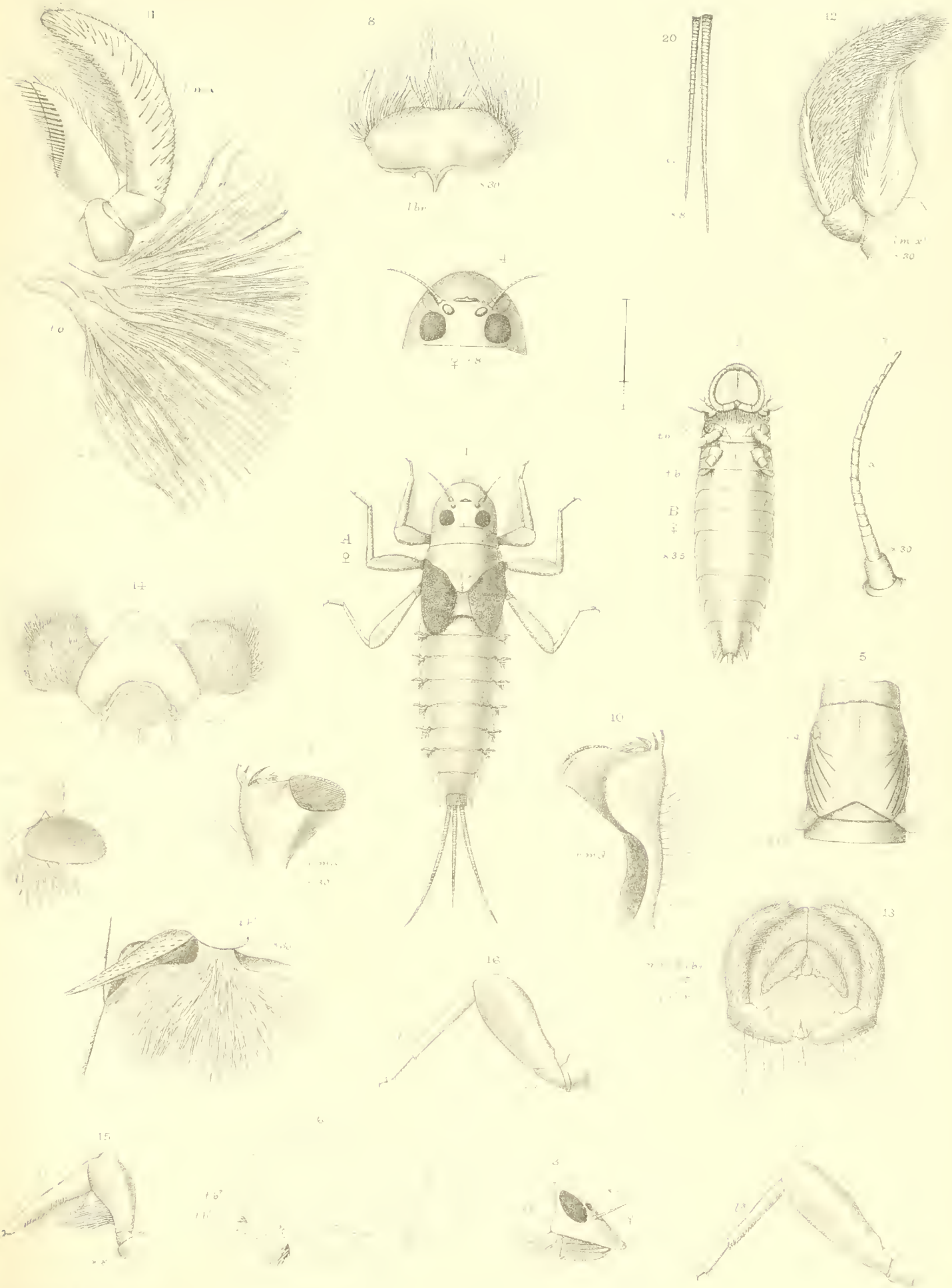




A. E. Eaton del. A. T. Hollick lith.

SUPPLEMENTAL TO PLATE XXIII.

West, Newman & C°imp.

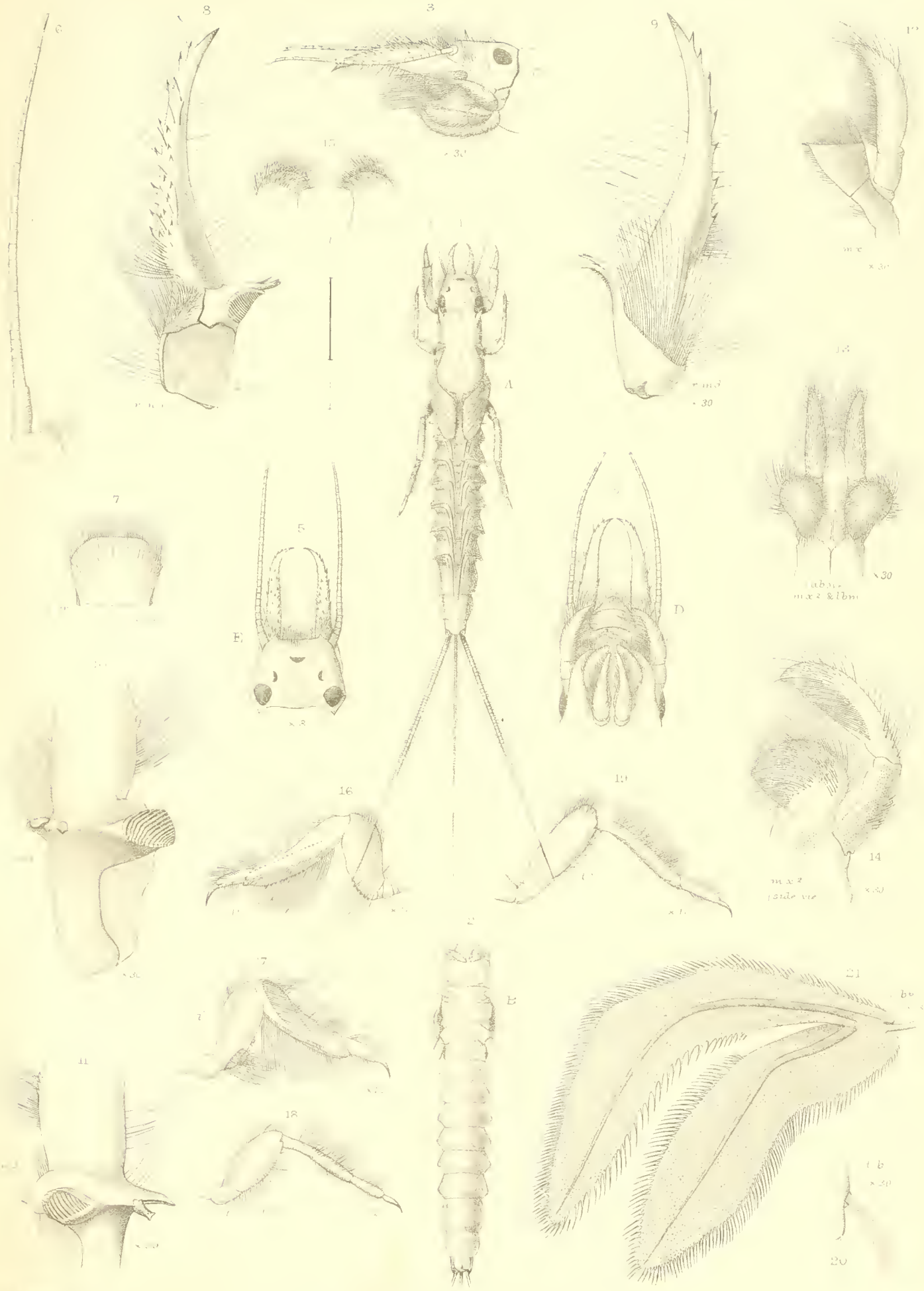


OLIGONEURIA RHENANA (Nymph.)

k del et lith.

JOLIA ROESELI — (Nymph)

West Newman & Co imp.



POLYMITARCIS VIRGO (Nymph)

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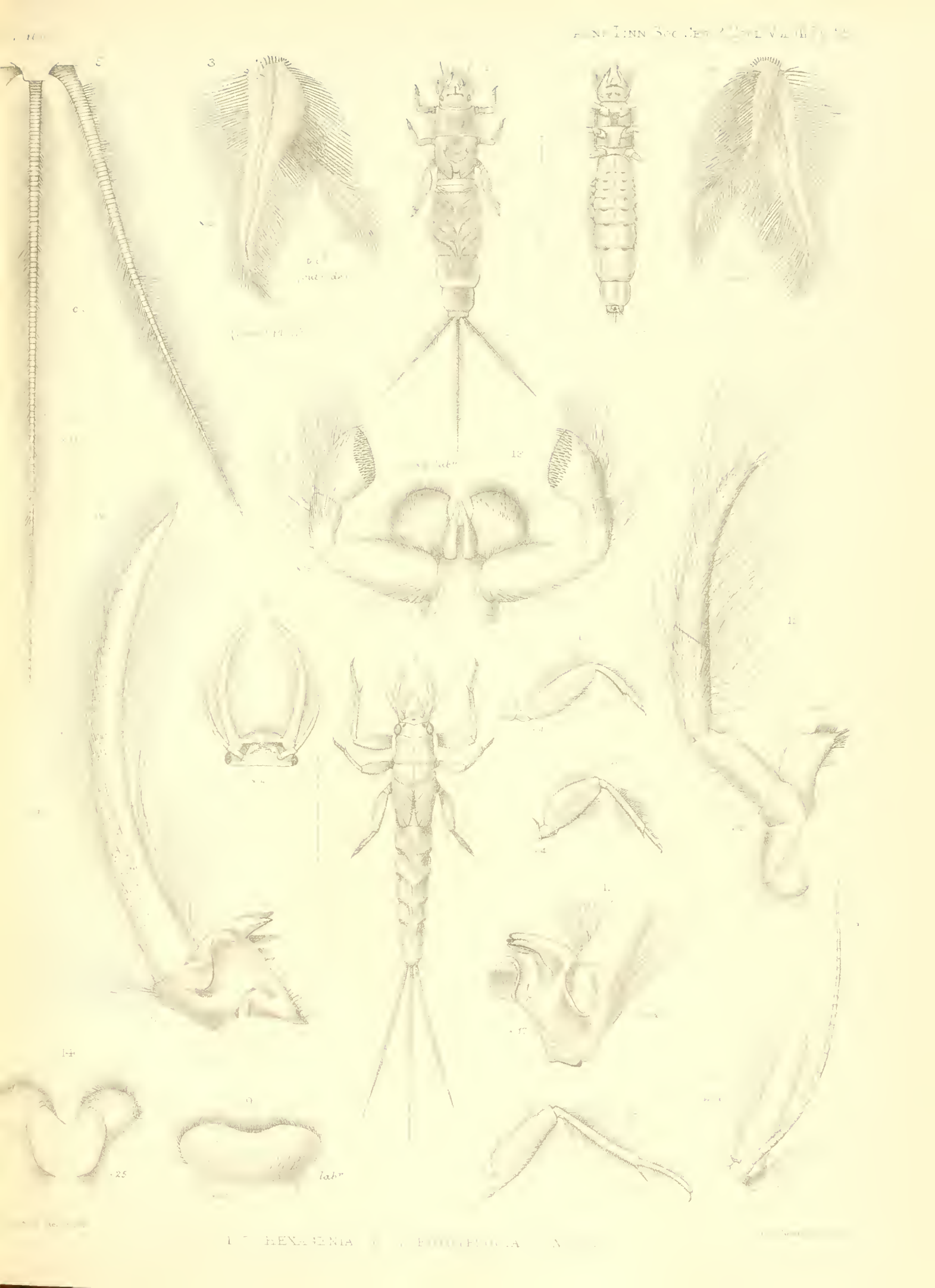
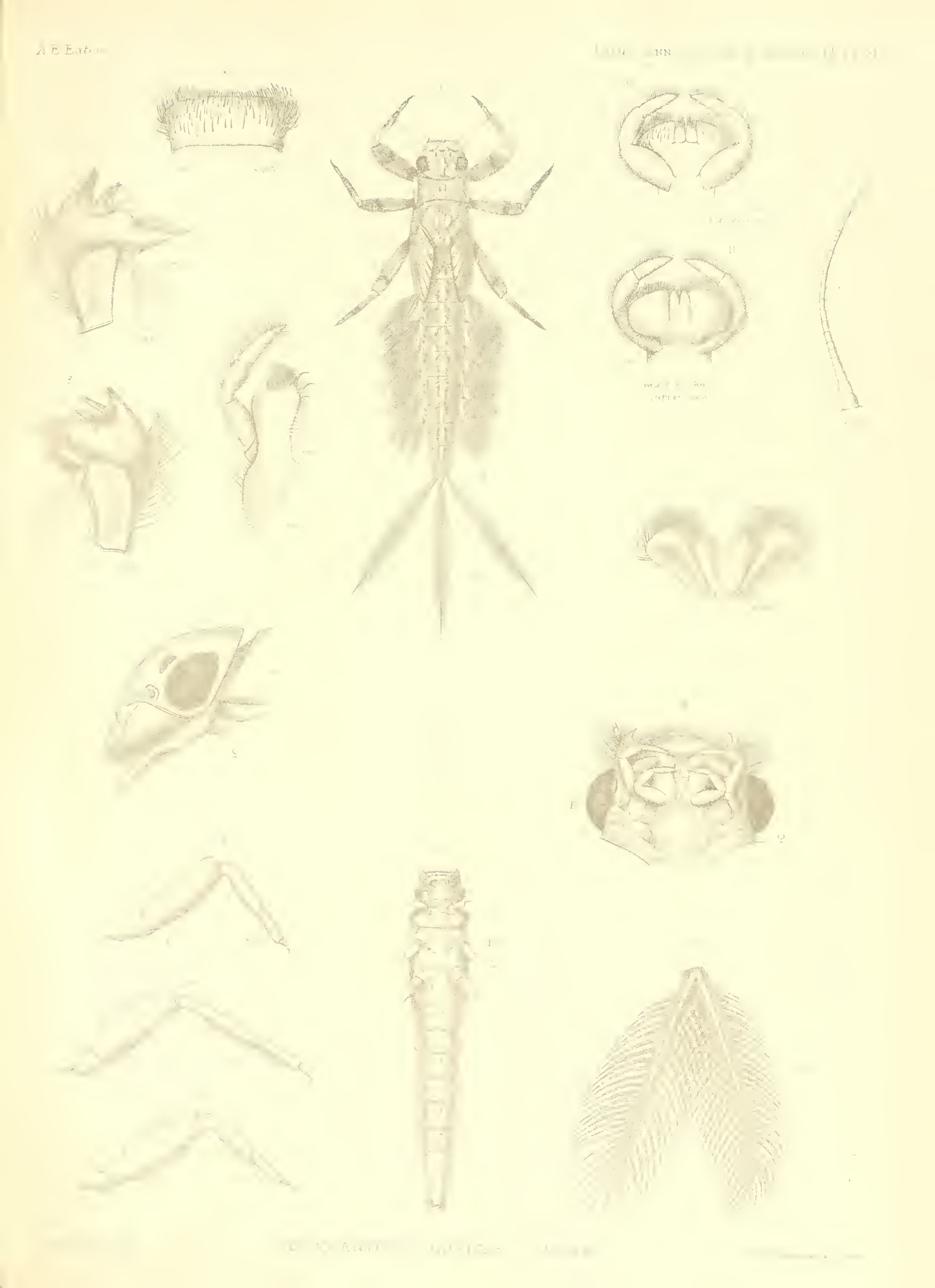
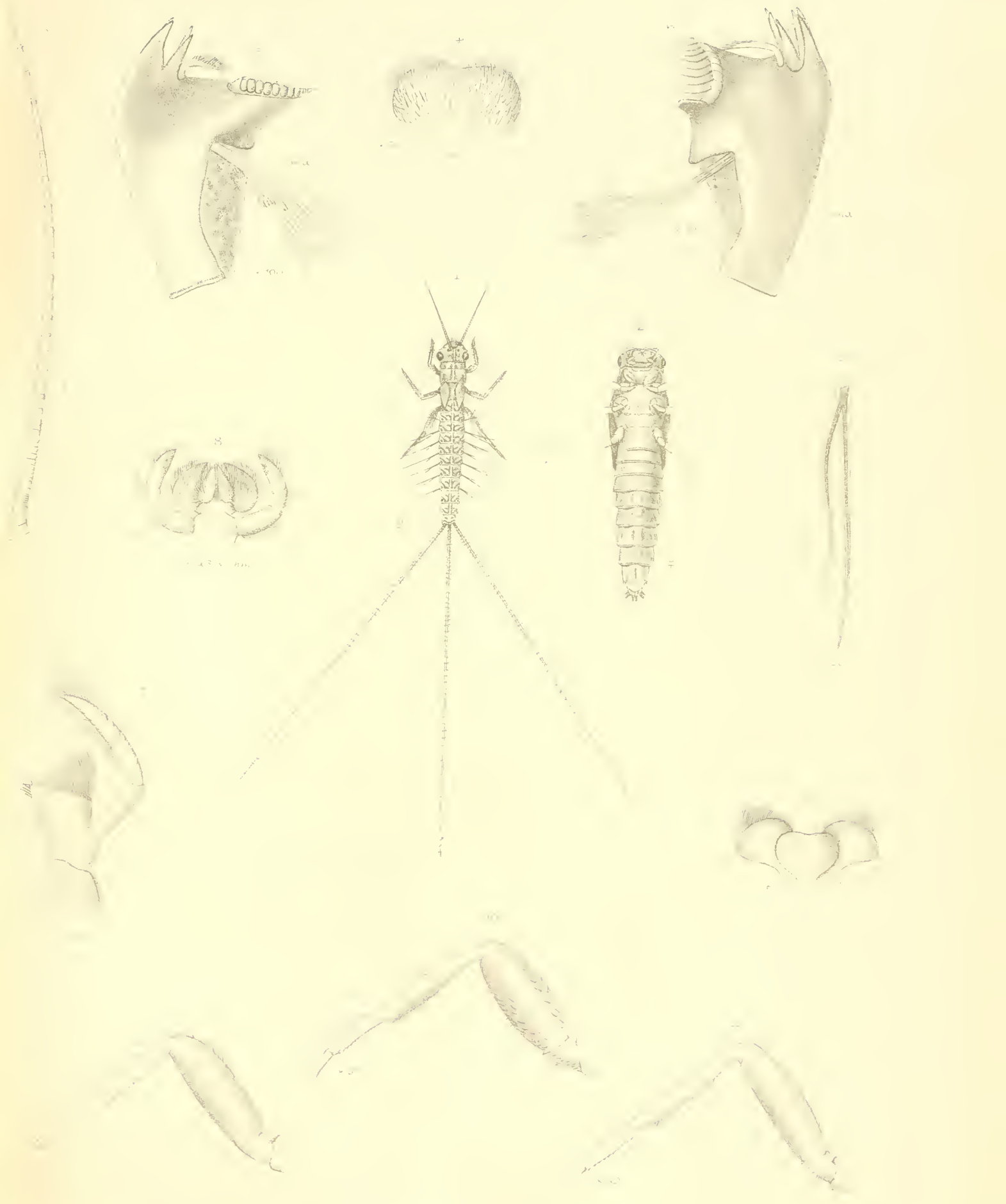


EPHEMERA VULGATA (Nymph)





LEPTOCERCIA CINCTA (Nymph)

West, Newman & imp.

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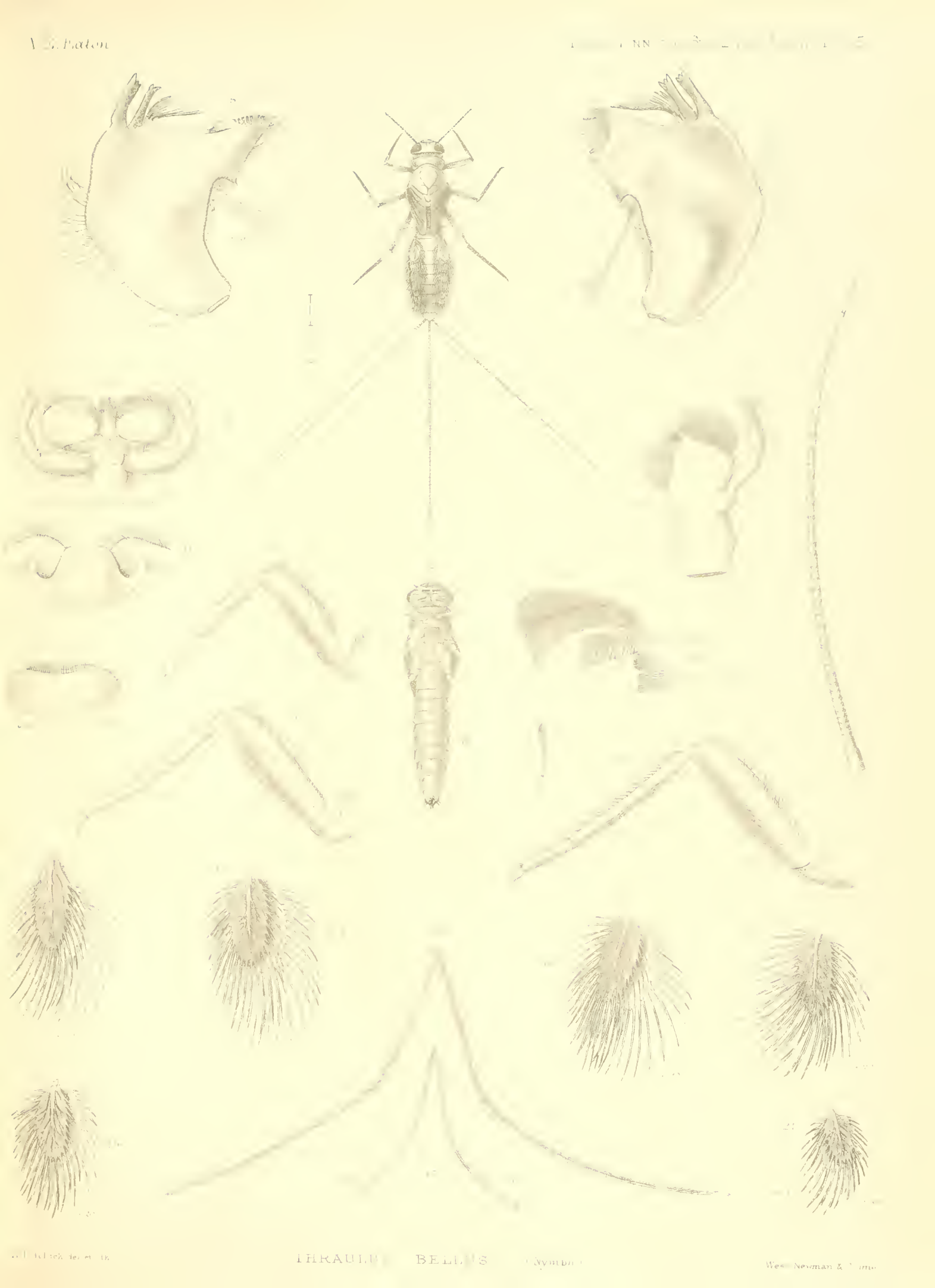
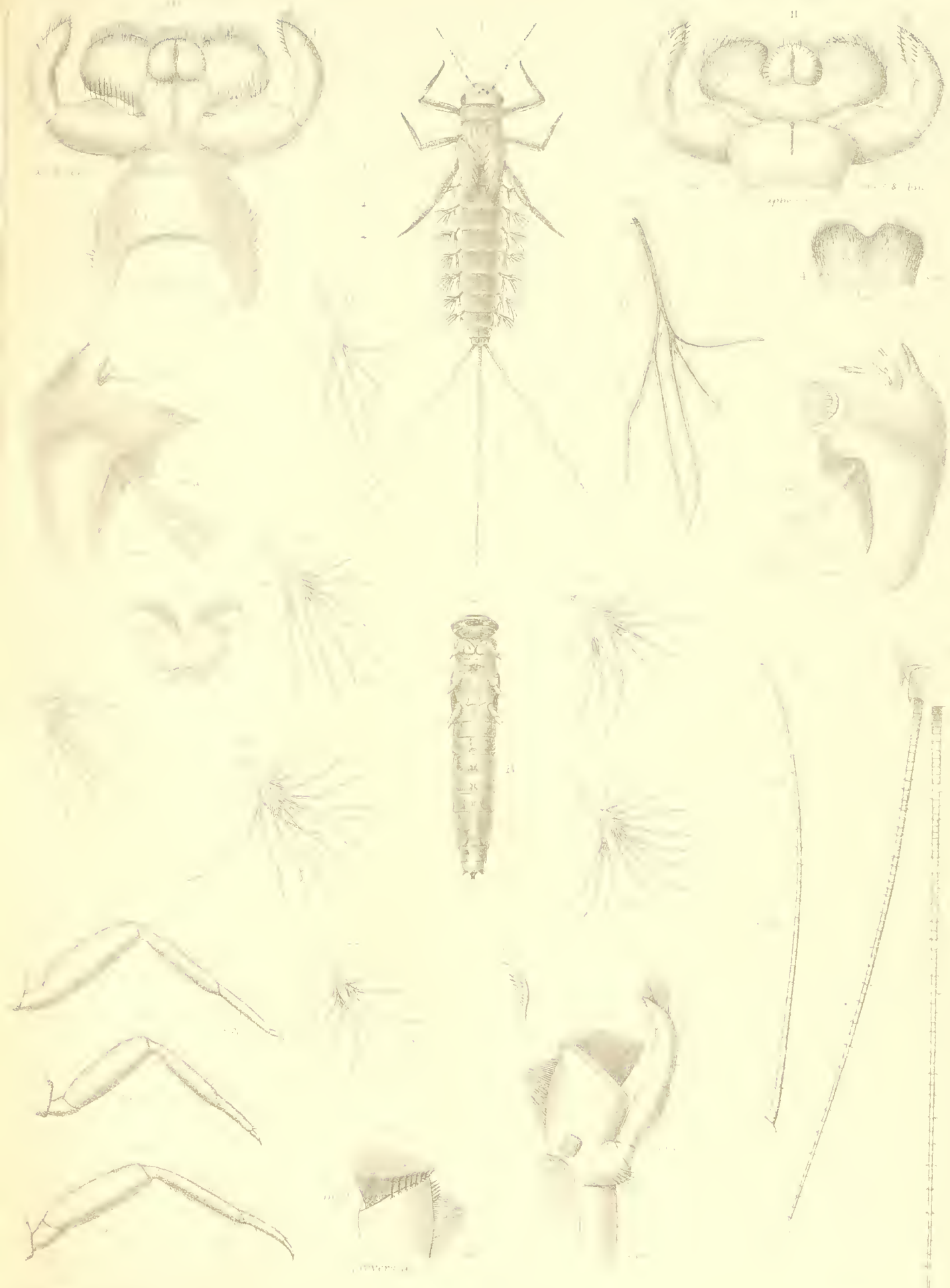
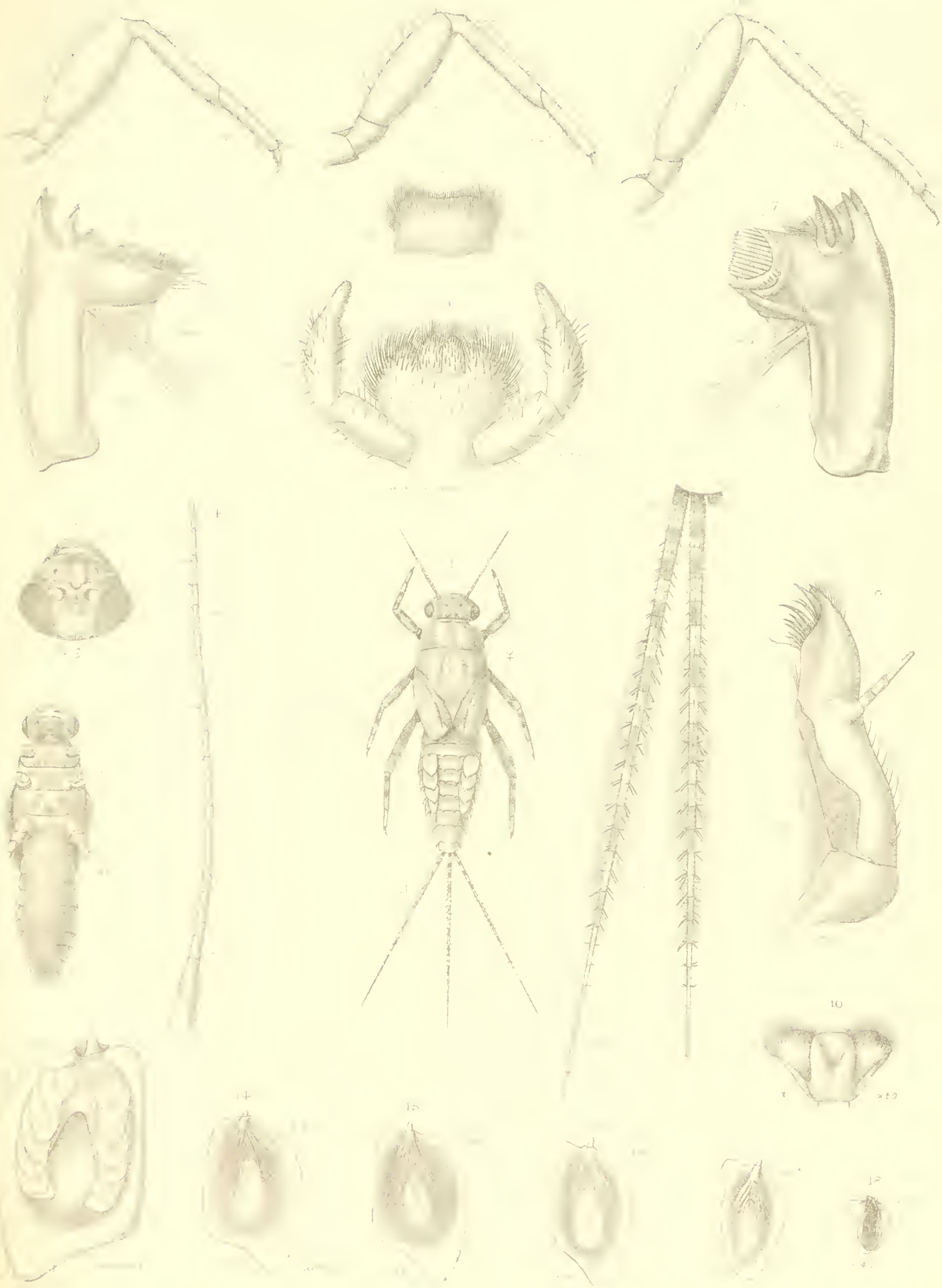
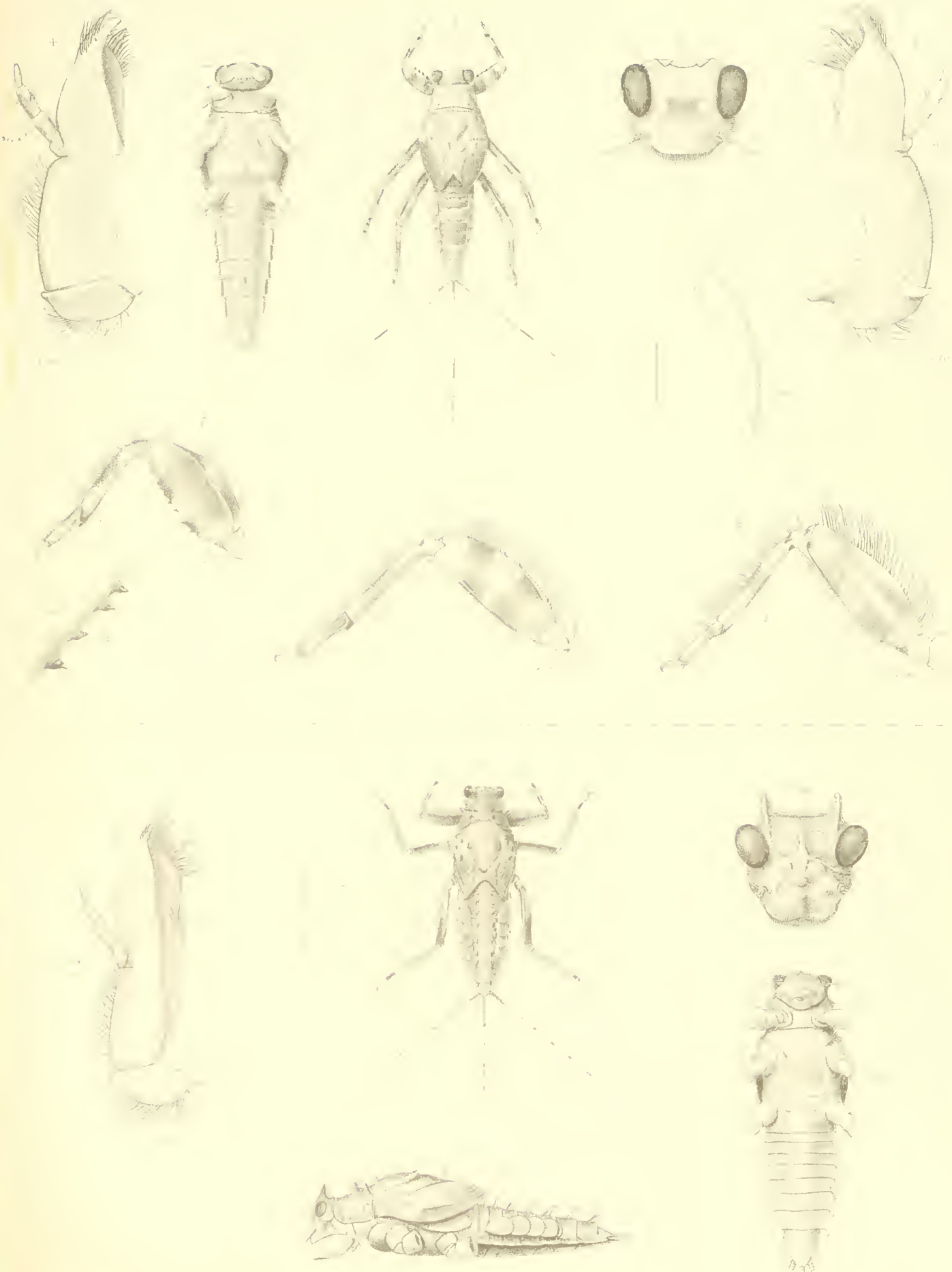
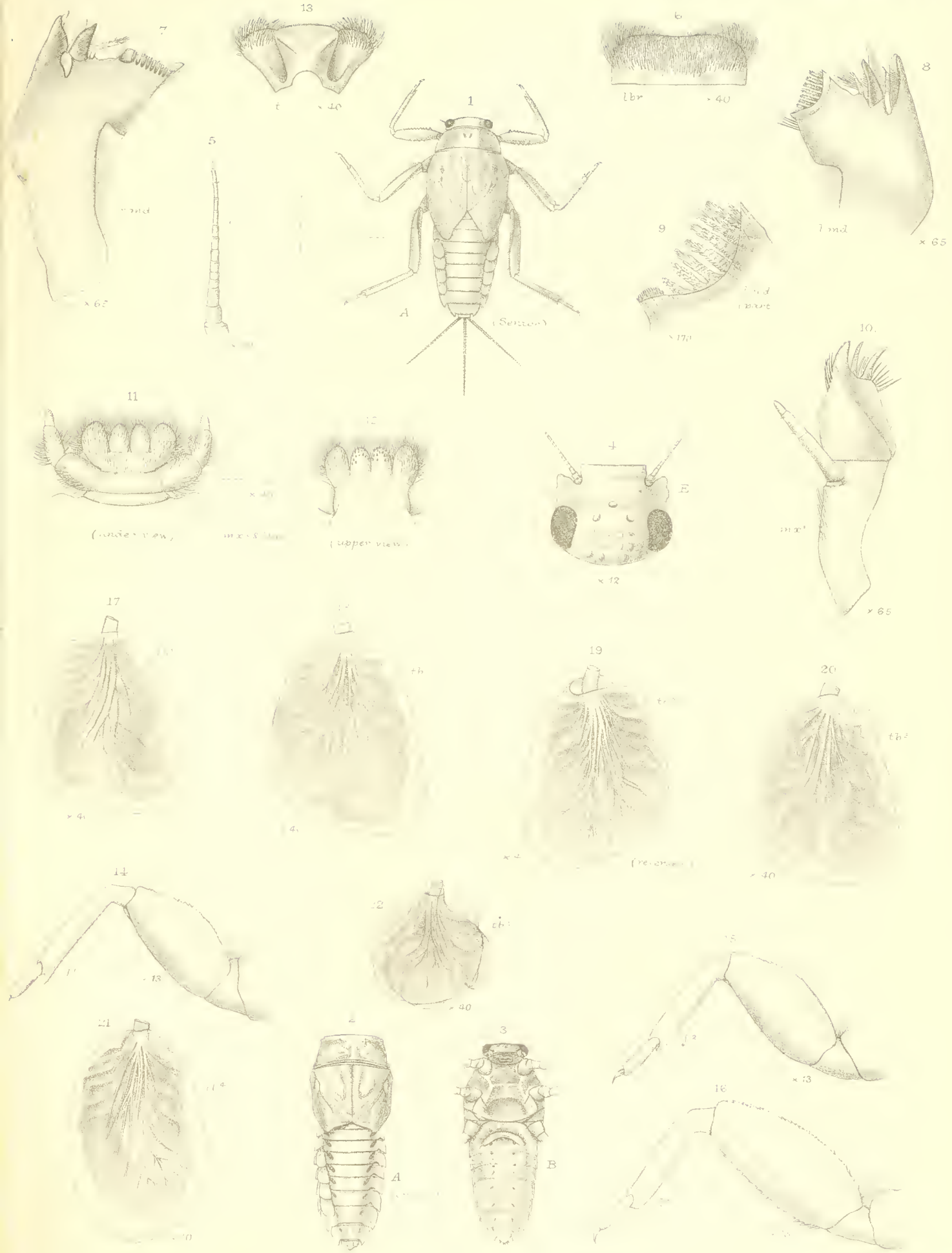




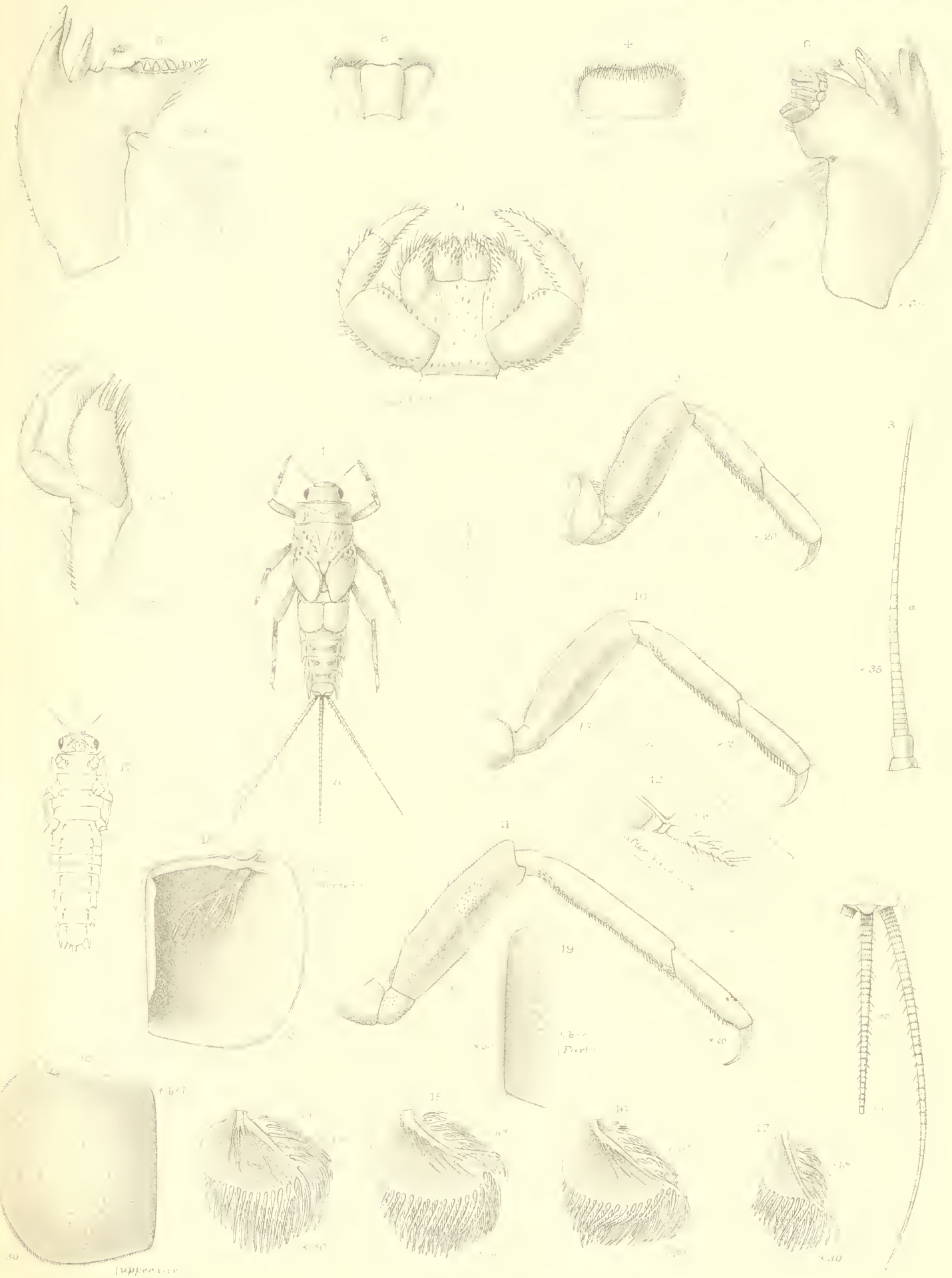
HABROPHLEBIA FUSCA







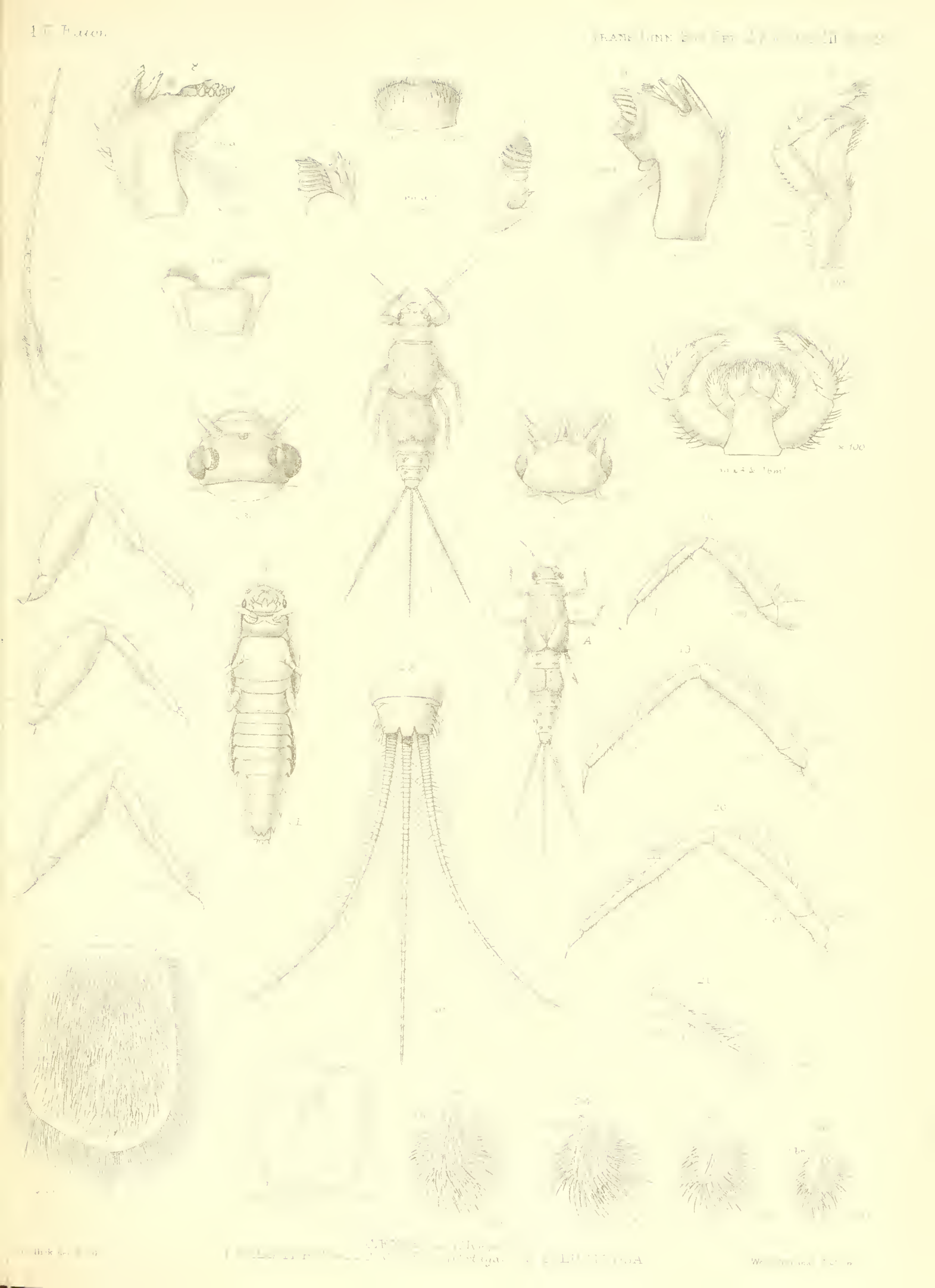
NAMELESS ALLY OF EPHEMERELLA.



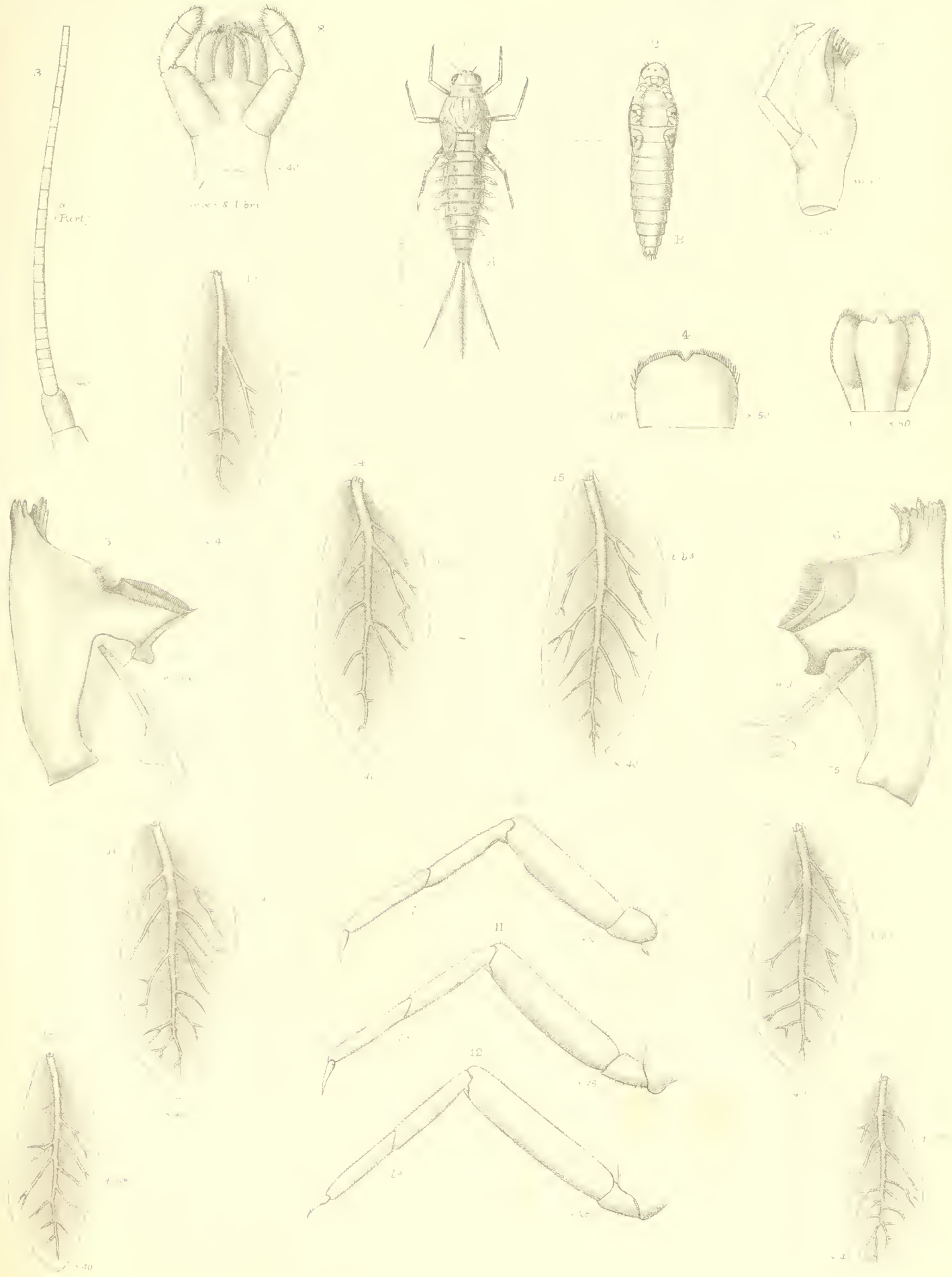
Hodgkin del. et lith.

TRICORYTHUS SP. (Nymph.). CÆNIS MAXIMUS, JOLY, M.S.

West Newman & Co. imp.

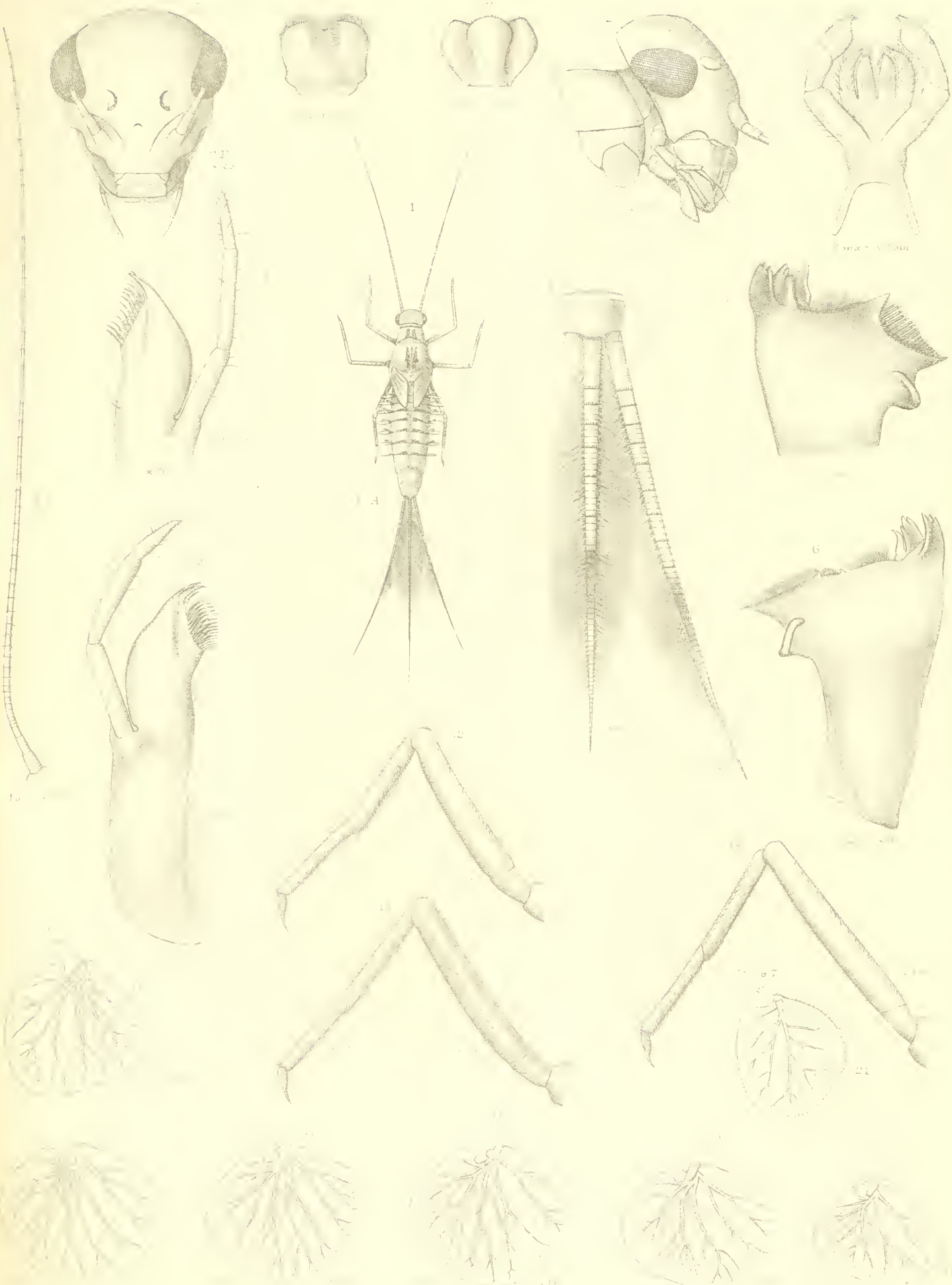


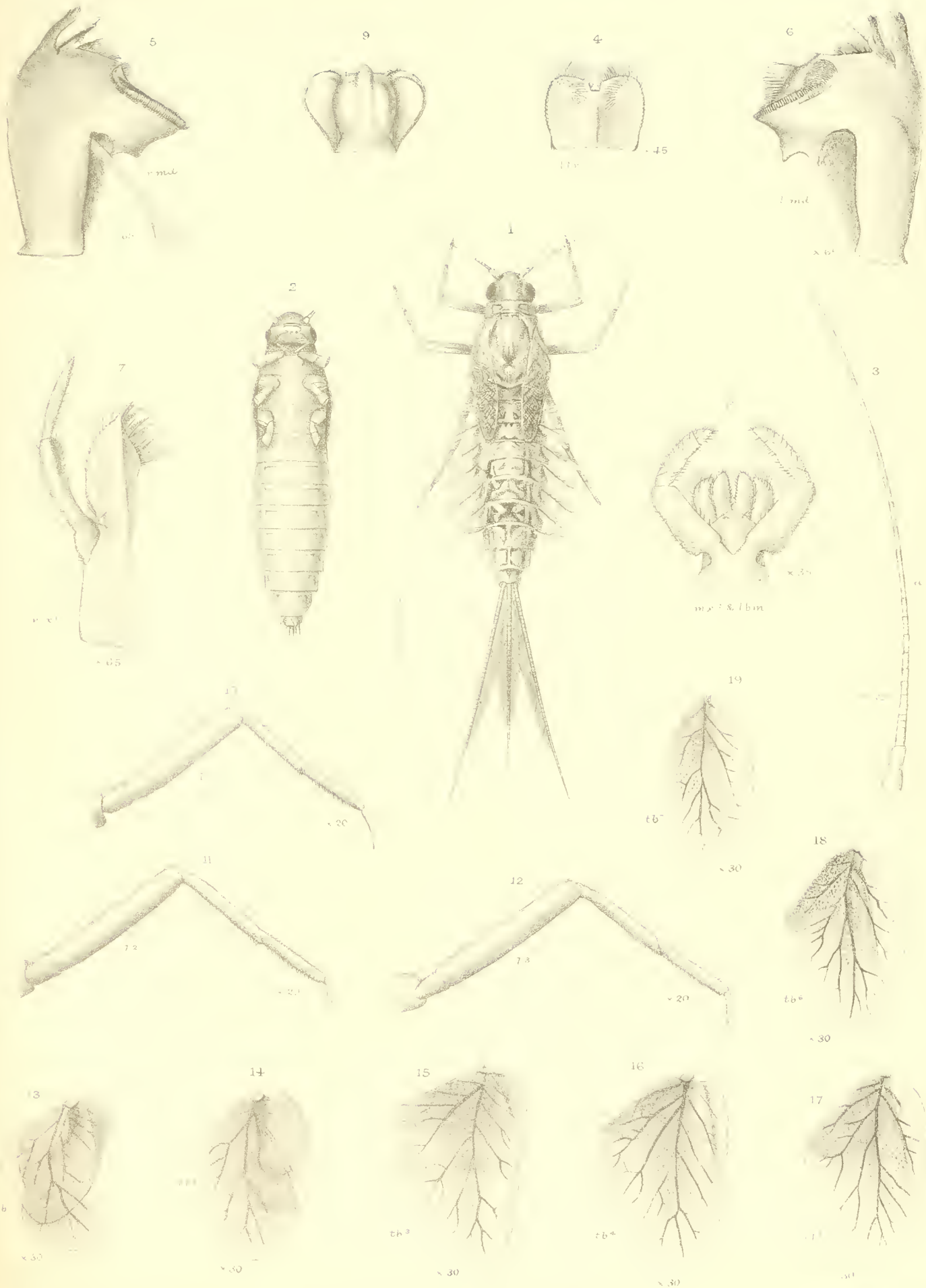
BAETIS RHODANI (Nymph)



A.T. Hollick del. et lith.

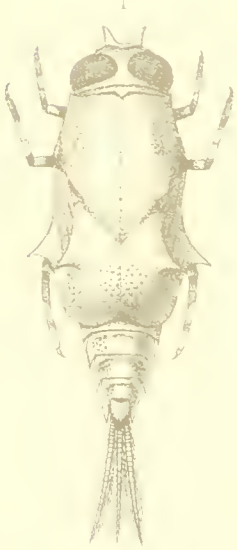
NAMELESS ALLY OF CENTROPTILUM — (Nymph) Puno Peru



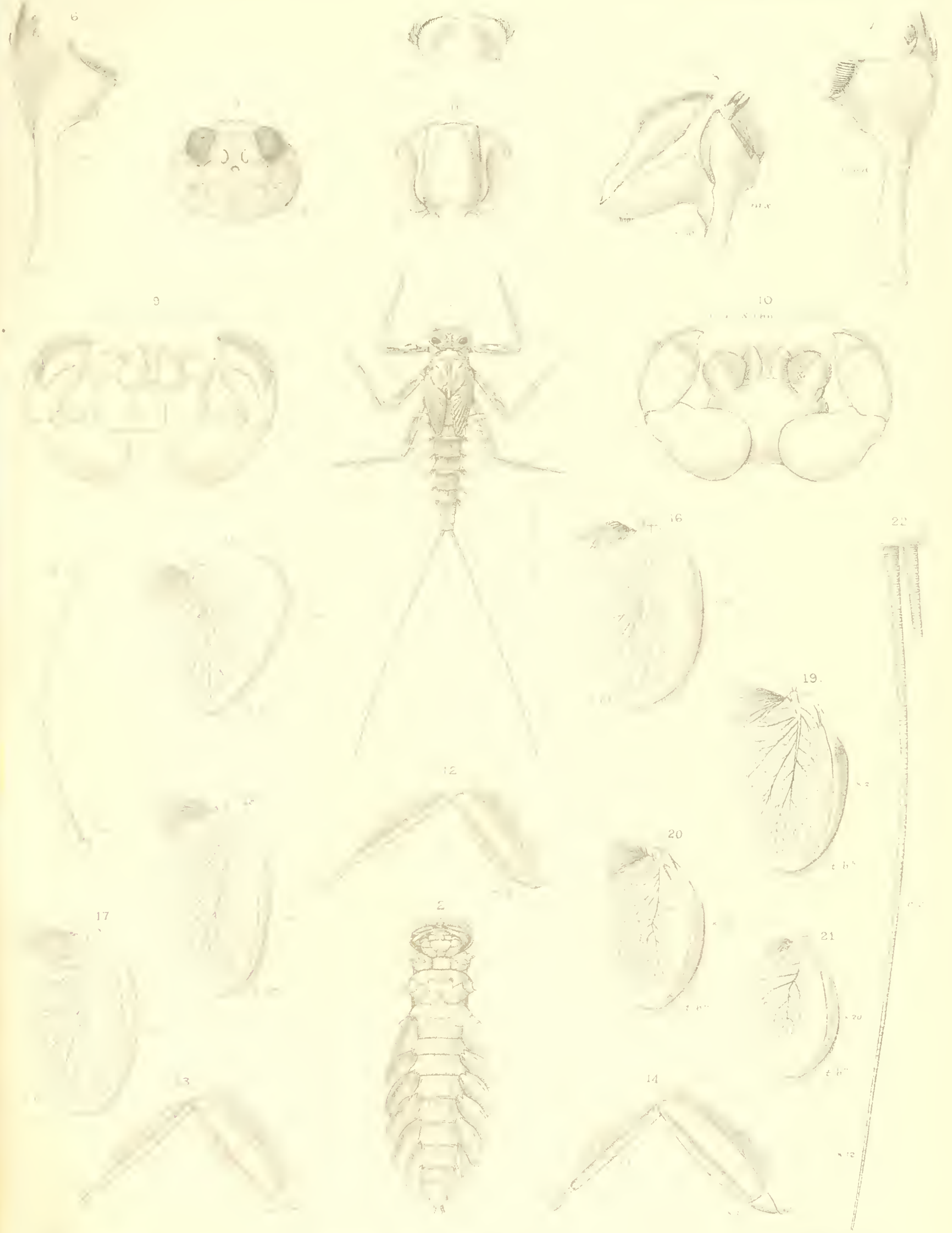


CALLIBÆTIS SP (Nymph)

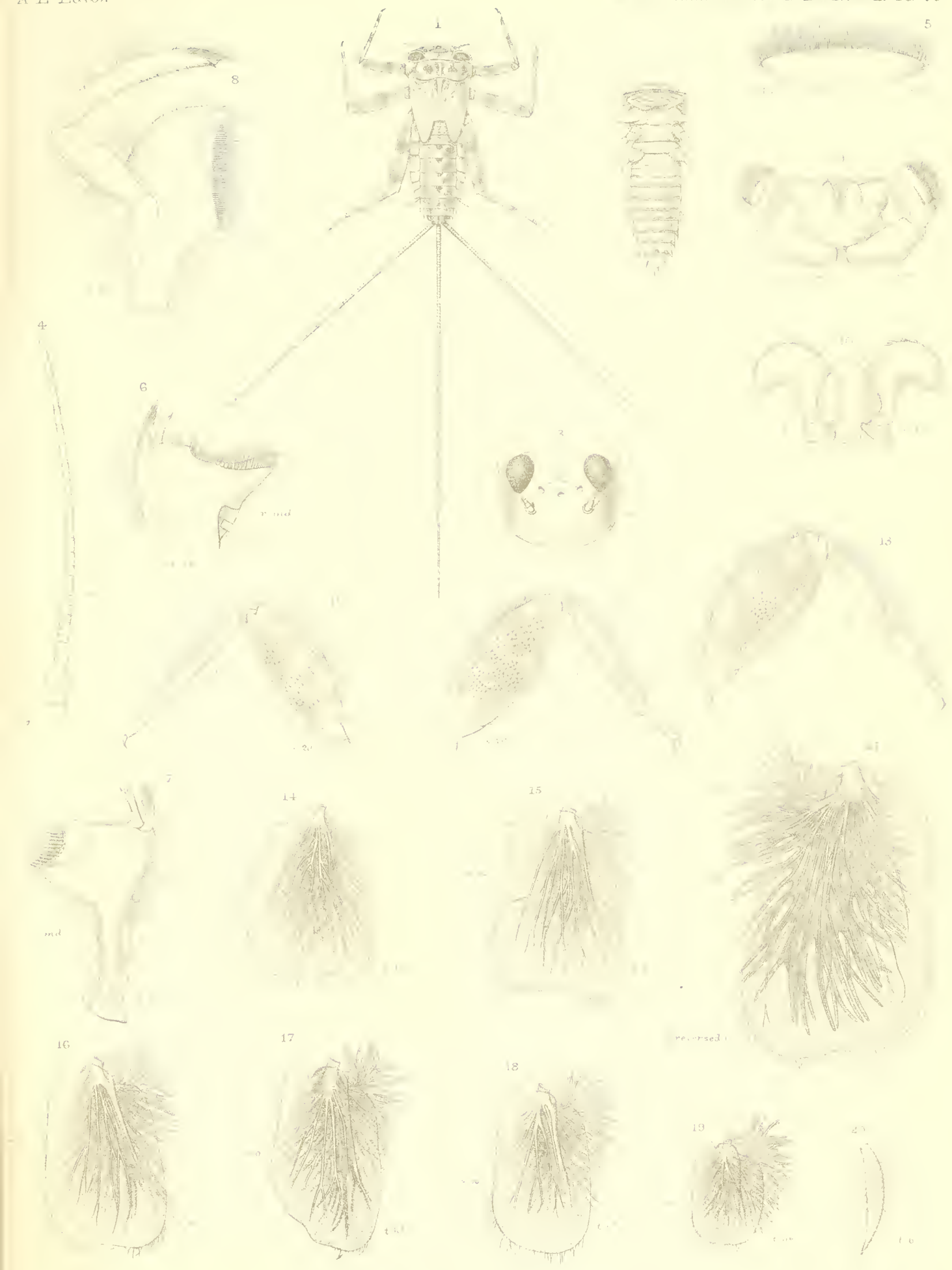
CHIEF NOTES OF [illegible]



West Newman & Co imp



[illegible] TORRENTIUM (Nymph)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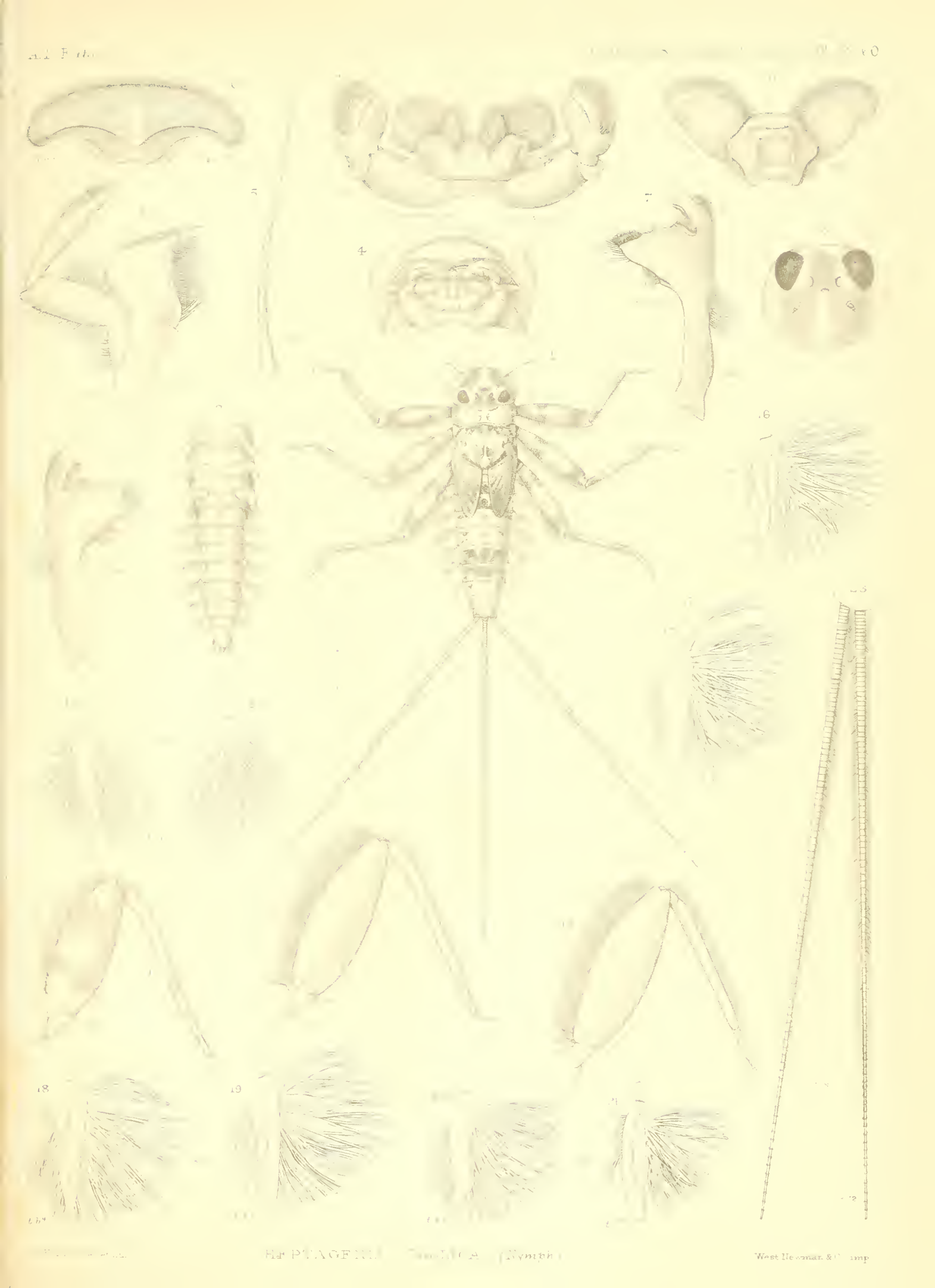

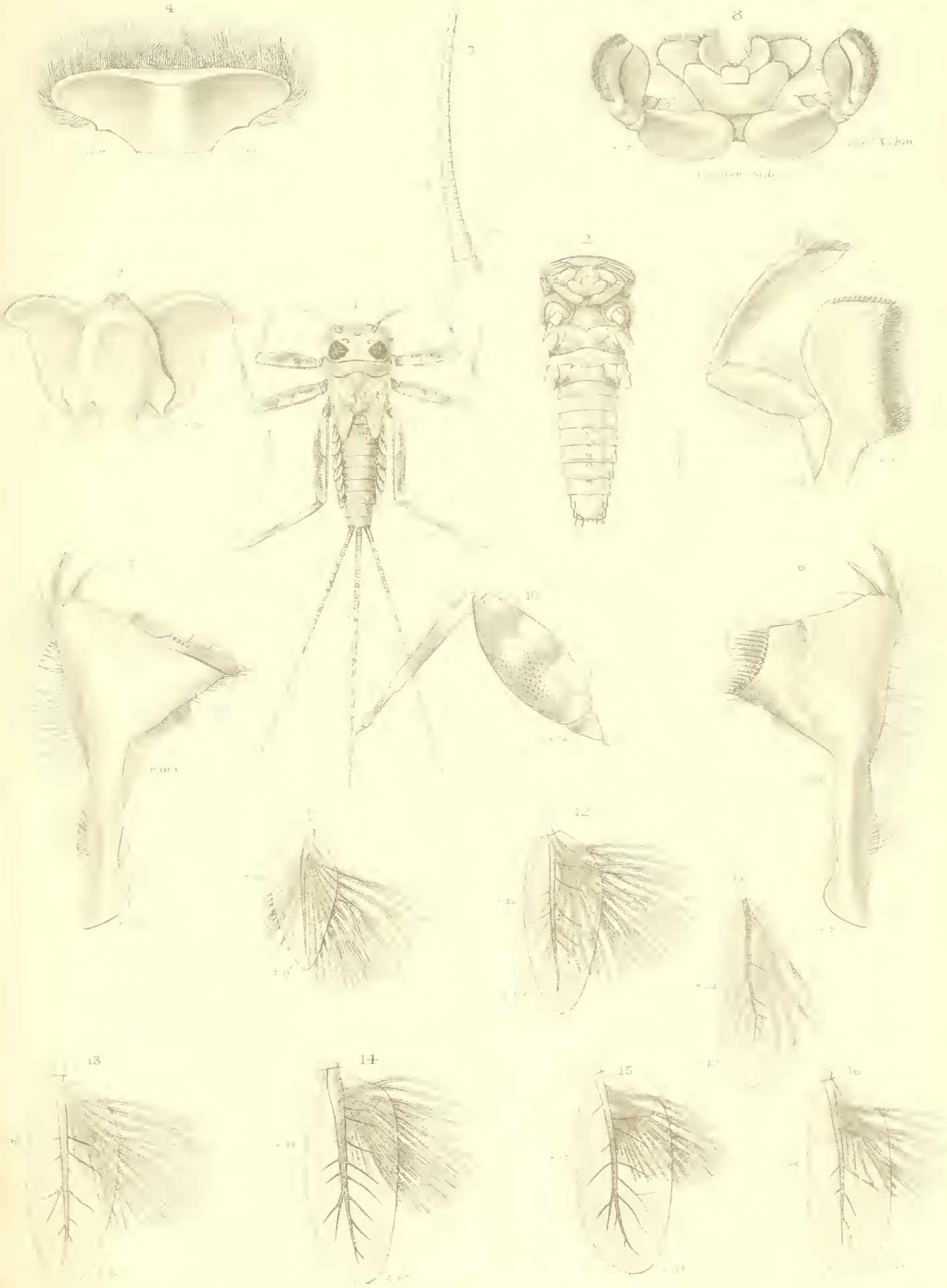

ECDYUR... Nymph ...
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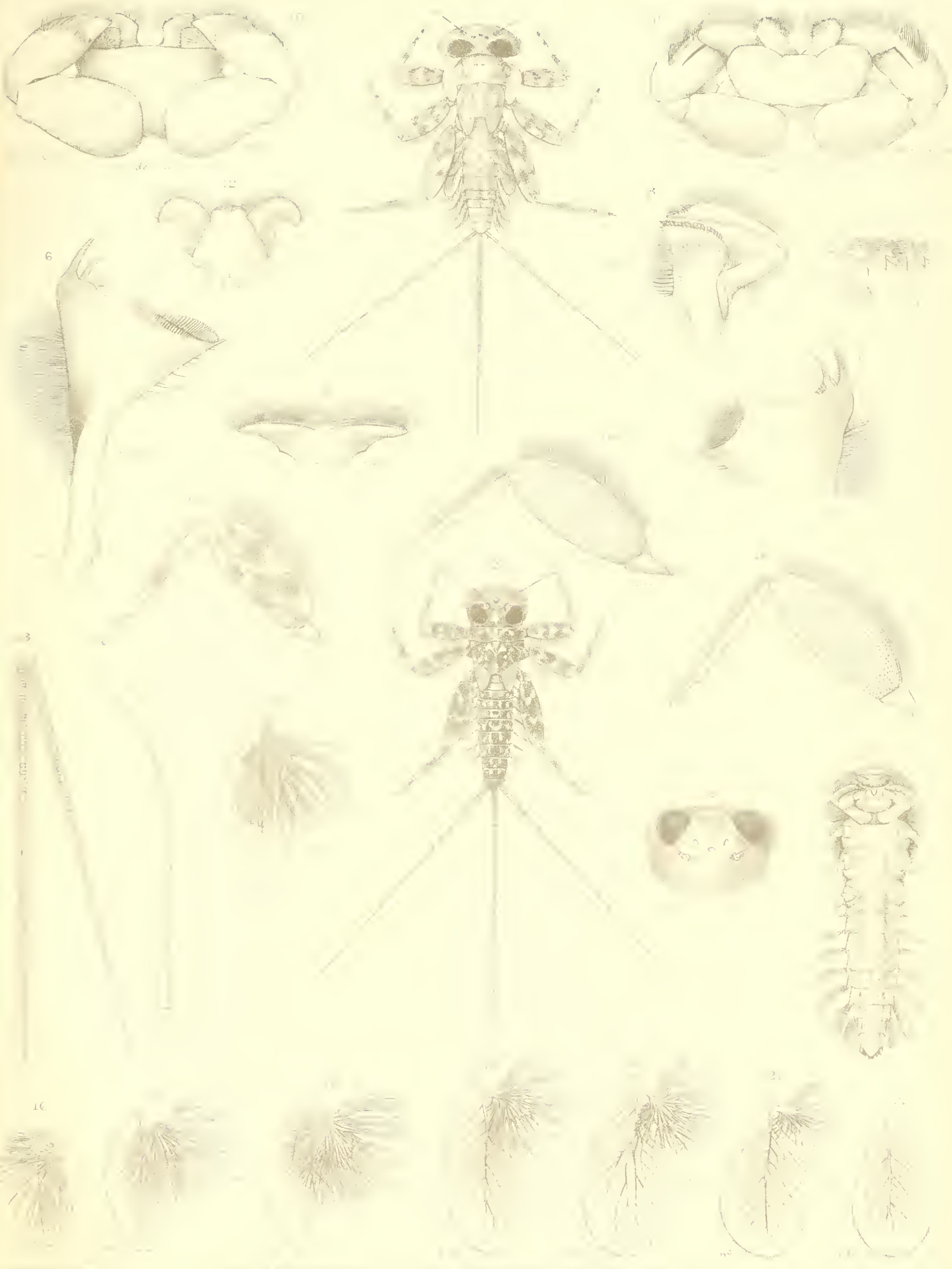

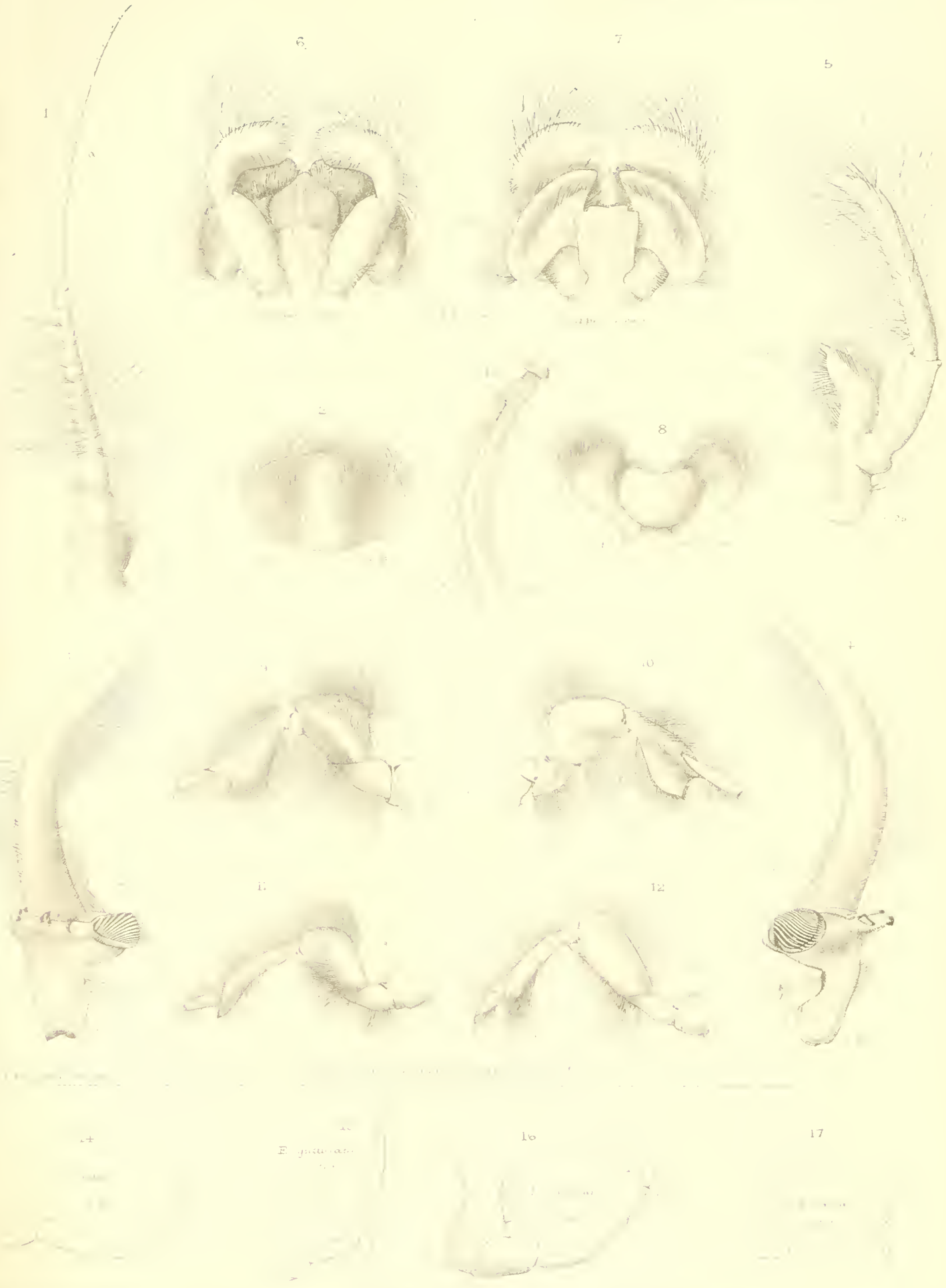
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A. E. Eaton

A. E. Eaton del.

A[illegible]ALOPHI[illegible] [illegible] HAP[illegible] LEB[illegible] [illegible] 9-20, BAETIS

21, CENTRO[illegible]ILUM 22-24, AMELET[illegible] 25, [illegible]TEROM[illegible]US 26, SIPHLURUS

1 EBLEPTUS 2–3, IRON 4–5, SINYGMA 6, RHITHROGENA (*Nymph*) 7 EPEORUS
8 Nameless 9, EPHEMERELLA 10–11, BAETIS 12 CENTROPTILUM. 13, AMELETUS

3.1884

2nd Ser. ZOOLOGY.] [VOL. III. PART 1.

THE

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OF

THE LINNEAN SOCIETY OF LONDON.

A REVISIONAL MONOGRAPH OF RECENT EPHEMERIDÆ OR MAYFLIES.—Part I.

BY

The Rev. A. E. EATON, M.A.

(*Communicated by* Sir John Lubbock, Bart., F.R.S., Pres. Linn. Soc.)

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Sept. 8, 1885.

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